विद्या प्रसारक मंडळ, ठाणे

Title	:	The wind-catchers of medieval Cairo and their secrets 1001 years of renewable energy: Part 2
Author	:	David A. King
Publisher	:	David A. King
Publication Year	:	2020
Pages	:	292

विद्या प्रसारक मंडळाच्या
"ग्रंथालय" प्रकल्पांतर्गत निर्मिती

गणपुस्तक निर्मिती वर्ष : 2020
गणपुस्तक क्रमांक : 131

The wind-catchers of medieval Cairo and their secrets

1001 years of renewable energy

This work is in two parts.
Part II, presented here, contains the illustrations.
Part I contains the overview of historical sources.

David A. King

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Part II – Illustrations

Acknowledgements: I am extremely grateful to all those authors who provided some of the illustrations for this monograph, and to all those websites on which I found the rest. Several colleagues assisted me in the lonely search for relevant pictorial materials, and I am particularly grateful to Olivier Jaubert (Paris), Alexandra Roy (London) and Subhi Azzawi (London). Others are mentioned *ad loc*.

Notes: References to most, but not all, of the images presented here in Part II are to be found in the text of Part I. These images have been arranged in the form of a "silent lecture" which can be viewed independently of Part I. Nevertheless, the reader should be aware that the images from after *ca*. 1800 reveal the end of the medieval tradition rather than its heyday.

Where possible the source of the images is indicated. Some of the historical images were found on the internet and no direct source is given there, so none is given here.

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Part Ia — The wind-catchers of medieval Cairo

Chapters with titles in brackets / parentheses contain material that is not immediately pertinent to the wind-catchers.

Part Ib — The secrets of the Cairo wind-catchers

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Table of contents of Part II

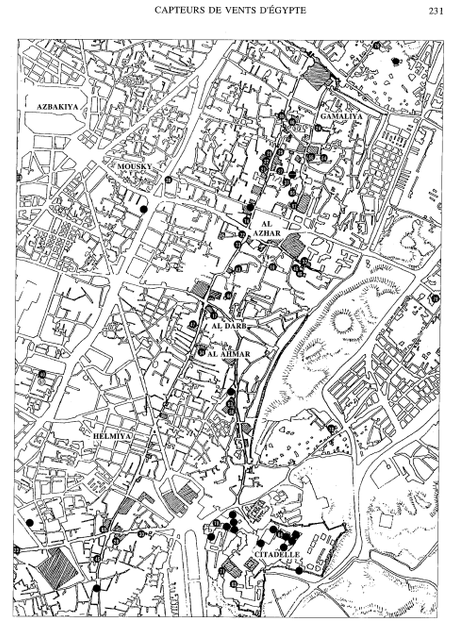
Introductory remarks to Part II:

The wind-catchers of Cairo, called بـــادهـــنج , *bādahanj* (and variants) in medieval Arabic, were a prominent feature of the city from the 10th C onwards. No images are known to survive from before the 16th C. We have only instructions for their construction and orientation in astronomical treatises (10th-17th C), references to them in historical works, *belles-lettres* and poetry (10th-14th C), as well as mentions in Near Eastern and European travellers' accounts (12th-19th C). Also, we have a recent inventory of 50 documented wind-catchers, most of which are no longer extant in their original form. In the medieval period these devices were to be found in hundreds and perhaps even thousands on the roofs of Cairo buildings.

For information on these written sources,
the reader is referred to Part I of this study.

Four studies on historical Cairene wind-catchers which are seldom mentioned in the modern literature but which perhaps merit consideration are:

(1) Alexandre Lézine, "Protection against heat in Islamic Egyptian architecture" (1971) (in French);
(2) Franz Rosenthal, "Poetry and architecture: The *bādhanj*" (1978);
(3) David A. King, "Architecture and astronomy: The ventilators of medieval Cairo and their secrets" (1984/2004);
(4) Olivier Jaubert, "The wind-catchers of Cairo – towards a typology" (1995) (in French).



Jaubert's map of known wind-catchers – see Pl. Q15.

These studies between them reveal that wind-catchers were in widespread use in Cairo from the 10th to the 19th C. For more information on these studies and for references to *bādahanj*es elsewhere, the reader is referred to Part I of the present monograph.

Two new studies of the Cairo *bādahanj*es have appeared more recently:

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جامعة عين شمس
قسم الآثار
شعبة الآثار الإسلامية

كلية الآداب

ملقف الهواء فى عمارة القاهرة فى العصرين المملوكى والعثمانى
(٦٤٨ - ١٣٣٢هـ/ ١٢٥٠ - ١٩١٤م)

(المجلد الأول)

رسالة مقدمة للحصول على درجة الماجستير فى الآثار الإسلامية

مقدمة من

الطالبة / لميس عزمى أحمد السيد الدسوقى

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القاهرة ٢٠١٤

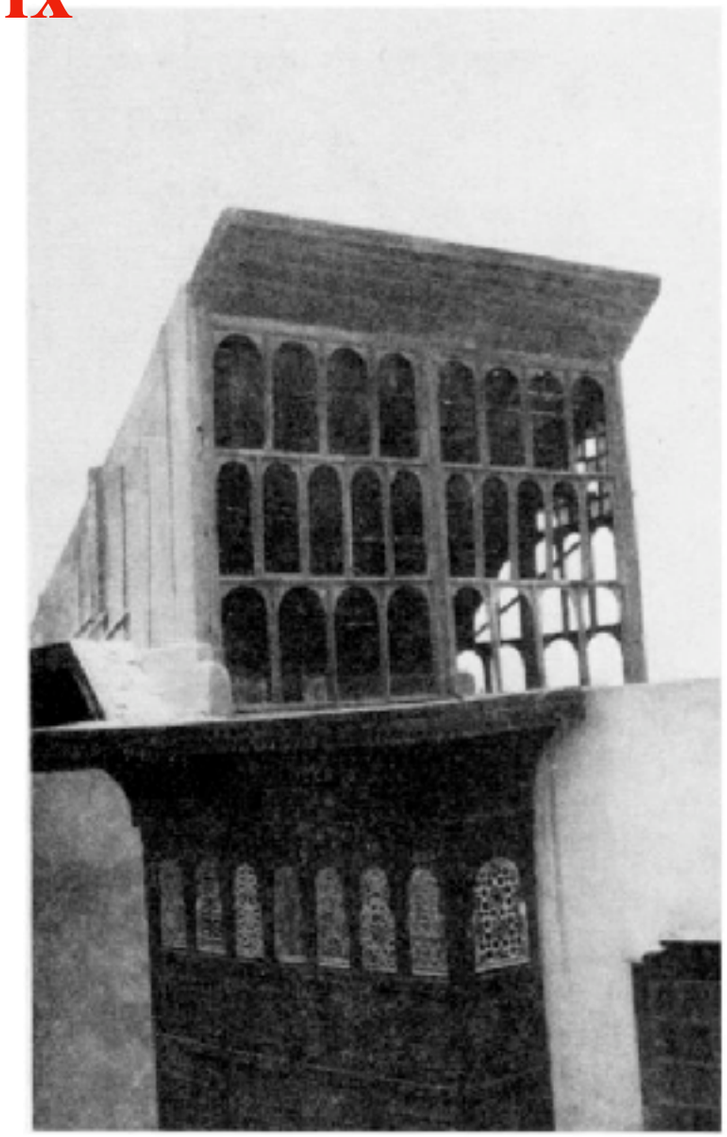
Lamees al-Dasouqi, *The wind-catcher in Cairene architecture during the Mamluk and Ottoman periods (1332-1914).*

The title-page and table of contents of an illustrated Master's thesis by Ms Lamees al-Dasouqi presented to Ayn Shams University in 2014. The thesis deals with Mamluk and Ottoman wind-catchers, apparently relying heavily on the information in the 1995 study of Olivier Jaubert and the author's personal encounter with some of the surviving examples. This work is alas not yet available for consultation; all enquiries went unanswered.

http://srv4.eulc.edu.eg/eulc_v5/Libraries/Thesis/BrowseThesisPages.aspx?fn=PublicDrawThesis&BibID=12103496

Alev Masarwa, “Urban architecture and poetry: Two medieval Arabic anthologies as manuals of mapping urban space” (2017).

This brilliant new investigation of two anthologies of medieval Egyptian poetry focusses on those verses dealing with wind-catchers. It begins where Franz Rosenthal’s 1978 article leaves off and goes far beyond. It is richly documented and will be important for future studies of the phenomenon.



Not a single book or article known to this author has been published during the past 200 years that has deliberately presented more than one or two of the available images of the wind-catchers of historic Cairo. The purpose of the present study is to show that such devices, large and small, were found on most religious and domestic architecture in the period from the 10th C to the 19th.

"I am a *bādahanj* all filled
With emotion, joy, and happiness.

High on top of me, the pigeons sing.
Inside me, the winds recite love poems."

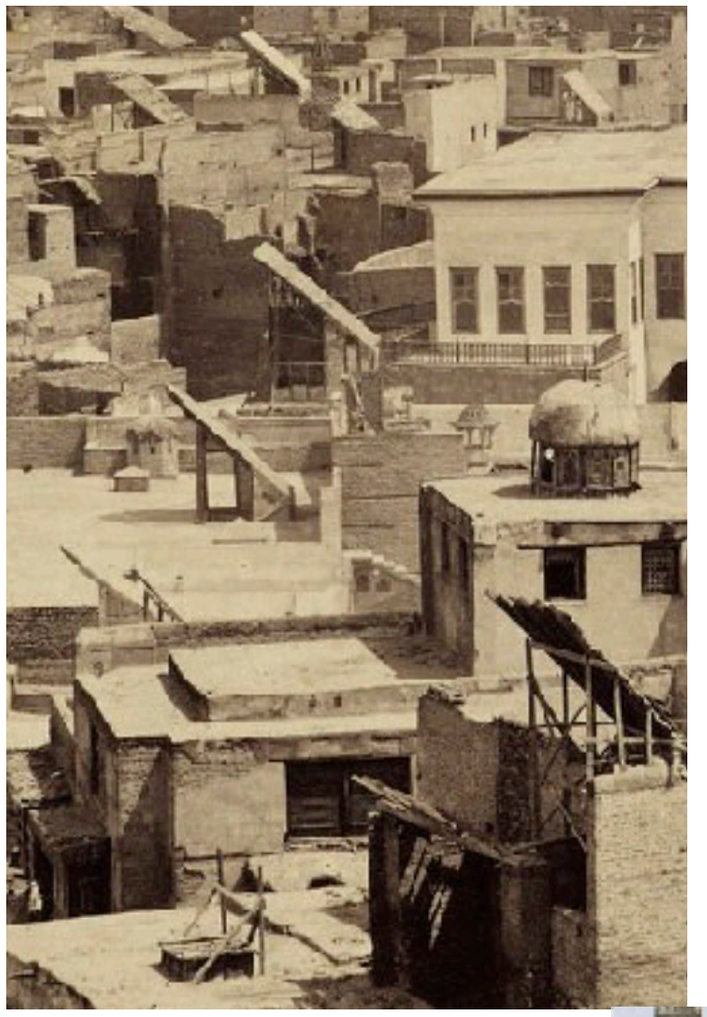
Burhān al-Dīn al-Qīrāṭī, Cairo, *ca*. 1350

The author is perfectly aware that the examples shown on this and the next page are not "medieval" (they both date from *ca*. 1800) but they are indeed representative of a medieval tradition. Of course, they were not all enormous like these two, but we have an 11th-C text which mentions a *bādahanj* of width 30 cubits, that is, some 20 metres.

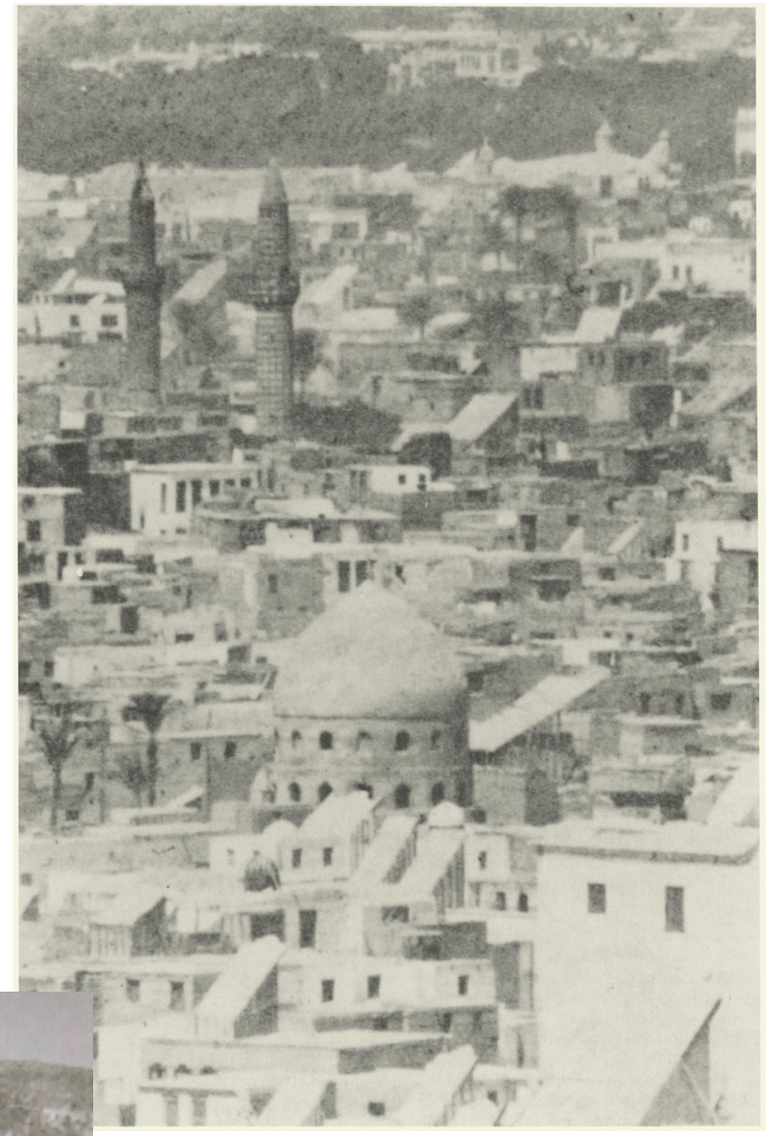
These wind-catchers were erected according to precise rules documented for us in medieval Egyptian astronomical treatises. However, they needed frequent care and attention and occasional replacement. Many of the wind-catchers had disappeared already already by around 1800; nevertheless, numerous European artists captured some remaining examples either on canvas or in photographs.

The ʿIrāqī scholar ʿAbd al-Laṭīf al-Baghdādī, who visited Cairo about the year 1200, observed:

"(The Egyptians) make the opening of their houses exposed to north and the agreeable winds, and one seldom (*qallamā*) sees houses without a wind-catcher (*bādhāhanj*). These wind-catchers of theirs are tall and wide, and open to every action of the wind; they are erected carefully and with much skill. One can pay between one hundred and five hundred dinars for a single wind-catcher, but small ones for ordinary houses cost no more than one dinar each."



This study is addressed to all specialists in the architecture of medieval Cairo who have ignored the wind-catchers which were a prominent feature of the skyline from the 10th to the 19th C and also to all specialists in environmental studies and other scholars who have been told that such sensible devices are found only in Iran and thereabouts.



Two views of the splendid Mosque of Ibn Ṭūlūn taken from the air around 1930 by the Swiss pilot Walter Mittelholzer (1894-1937) and by an unnamed R.A.F. pilot. There is not a wind-catcher to be seen. Perhaps they all disappeared? Or perhaps the wind-catchers were not on every building or in every part of the medieval city?

www.theguardian.com/cities/gallery/2017/jul/05/1930s-cities-from-the-air-aerial-photographs-walter-mittelholzer-in-pictures

The other available pictorial materials create the impression that the wind-catchers were in common use in particular areas of what was left over of the medieval city. And around the Mosque of Ibn Ṭūlūn it appears that there were no wind-catchers, yet earlier images reveal that houses around the Mosque were once richly provided with them.

Hautecœur & Wiet, *Les mosquées du Caire*, (1932), vol. 2. from an R.A.F. source.

Sources for the history of the Cairo wind-catchers

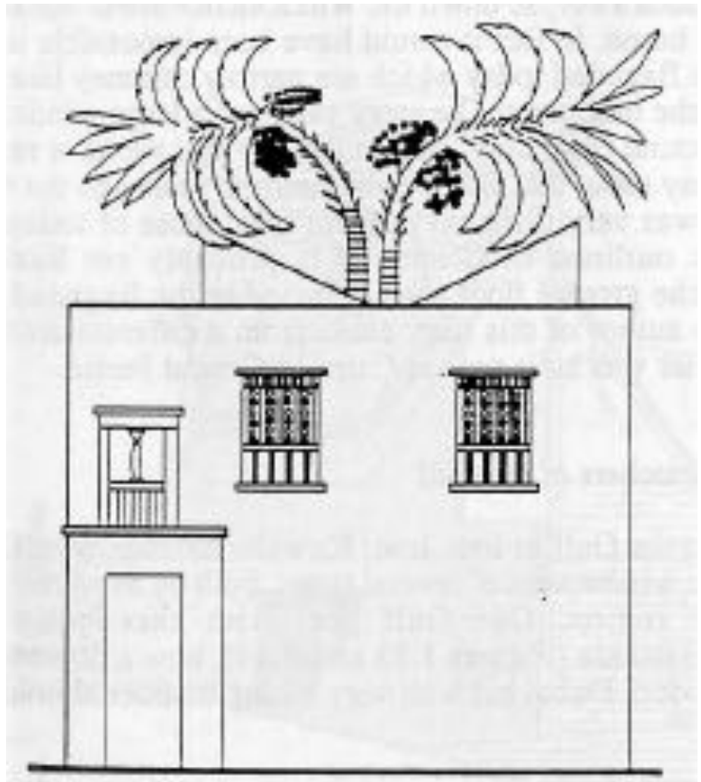
***Nota bene*: The term *bādhahanj* (and variants thereof) for these devices during C10-C19 is an Arabicized Persian word. The modern Egyptian term *malqaf* dates only from C19.**

Pre-C10……Illustrations of Ancient Egyptian wind-catchers on papyri; examples on churches
C10……Occasional references to the term *bādahanj*
969…….Foundation of Cairo (with minor axis toward winter sunrise); earliest recorded *bādahanj* in al-Azhar Mosque (970)
C10/2…….Astronomical text (Ibn Yūnus); table for orienting the *bādahanj* with respect to winter sunrise
C11…….Poetry; historical references
C12…….Poetry; two Geniza documents
1200……Traveller's account mentioning *bādahanj*es on most buildings (ʿAbd al-Laṭīf al-Baghdādī)
C13……Poetry
C13/14……Astronomical tables (Ibn al-Rashīdī); mention in *1001 Nights*
C14…….Astronomical texts (al-Bakhāniqī); poetry; earliest surviving *bādahanj*
C15…….Astronomical texts; surviving examples
C16…….Astronomical texts; surviving examples; traveller's account (Alpini)
C17…….Traveller's account (Evliya Chelebi); surviving examples
1800……*Description de l'Égypte* (documents numerous examples now lost)
C19…….Various European artists; surviving examples
C19/2……..Various European photographers; surviving examples
C20/1……..Various European artists and photographers; few surviving examples
C20…….Documentation of few surviving examples by Creswell, Maury *et al.*
C20/2……..Studies by Rosenthal on poetry (C11-14) & King on astronomical texts relating to medieval wind-catchers (C10-C16) & Jaubert on documentation of known examples, all subsequently overlooked (until 2014)
1998……Finest surviving example of a Fatimid/Mamluk/Ottoman-type *bādahanj* burned to the ground
C21/1……..Emergence from obscurity

A

A: Illustrations from Pharaonic Egypt

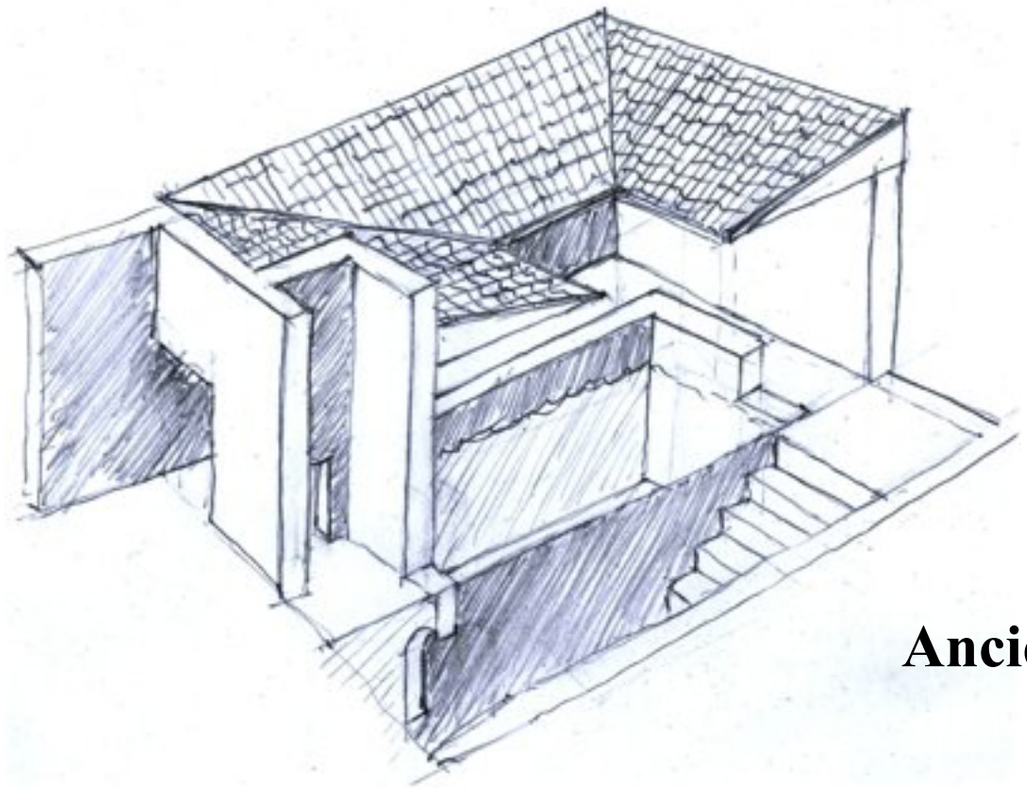
A1



A modern rendering of a well-known Pharaonic painting of wind-catchers on the house of Neb-Ammun, from a wall painting in his tomb (19th Dynasty, *ca*. 1300 B.C.E., British Museum). The question is: are these really wind-catchers at all and why are they facing opposite directions? The wind-catchers of medieval Cairo were not necessarily derived directly from such ancient devices, if the latter indeed existed, not least because they had a Persian name بادهنج , *bādhāhanj*, and one variety was called فراتي , *furātī*, from the Euphrates, suggesting an Iraqi connection.

Image is omni-present.

A2



Ancient Egyptian model of a house showing what in relief can look like wind-catchers, dating from Early Dynastic Period of Egypt. Found in Abou Rawsh near Cairo; now in the Musée du Louvre.

And how precisely did the ancient Egyptian wind-catchers, if such they were, function? A reconstruction of a house from a ground-plan on papyrus discovered at the rubbish-dump at Oxyrhynchus. Recent investigations have cast new light on the few available illustrations and models.

From di Nardo & Rossi & Palmero, "From the redrawing of the papyri to the paradigms of passive ventilation" (2016).

A3

This detail from a papyrus of the *Book of the Dead* features less frequently in the genre of modern literature in which it is taken for granted that the wind-catchers of medieval Cairo represent a direct continuation of the Ancient Egyptian tradition.

From the *Book of the Dead*, Papyrus of Nakht: Worshiping Osiris. Provenance unknown. New Kingdom, *ca.* 1300 B.C.E.).

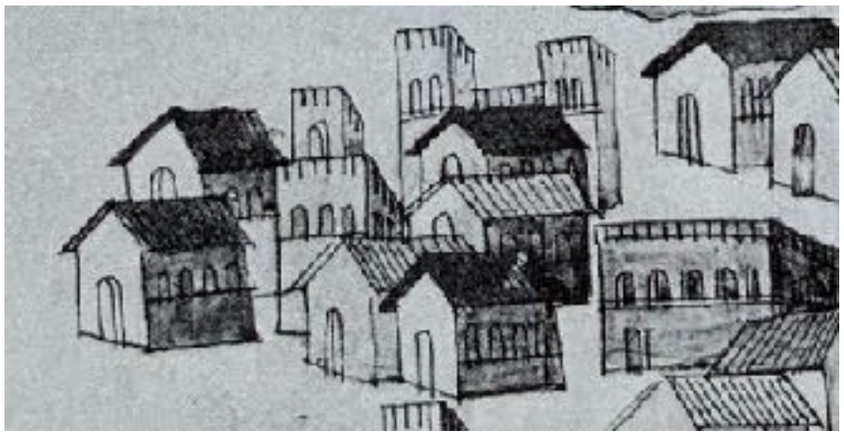
From di Nardo & Rossi & Palmero, "From the redrawing of the papyri to the paradigms of passive ventilation" (2016).

B

B: Various illustrations before 1750

B1

The oldest supposed image of Cairo, datable *ca*. 1480. Notice that the houses have European-type roofs. The image probably has nothing to do with Cairo for it could represent any town in France, although the palaces look rather Italian. Occasional towers are not necessarily supposed to be wind-catchers. It is significant that no mosques are shown.



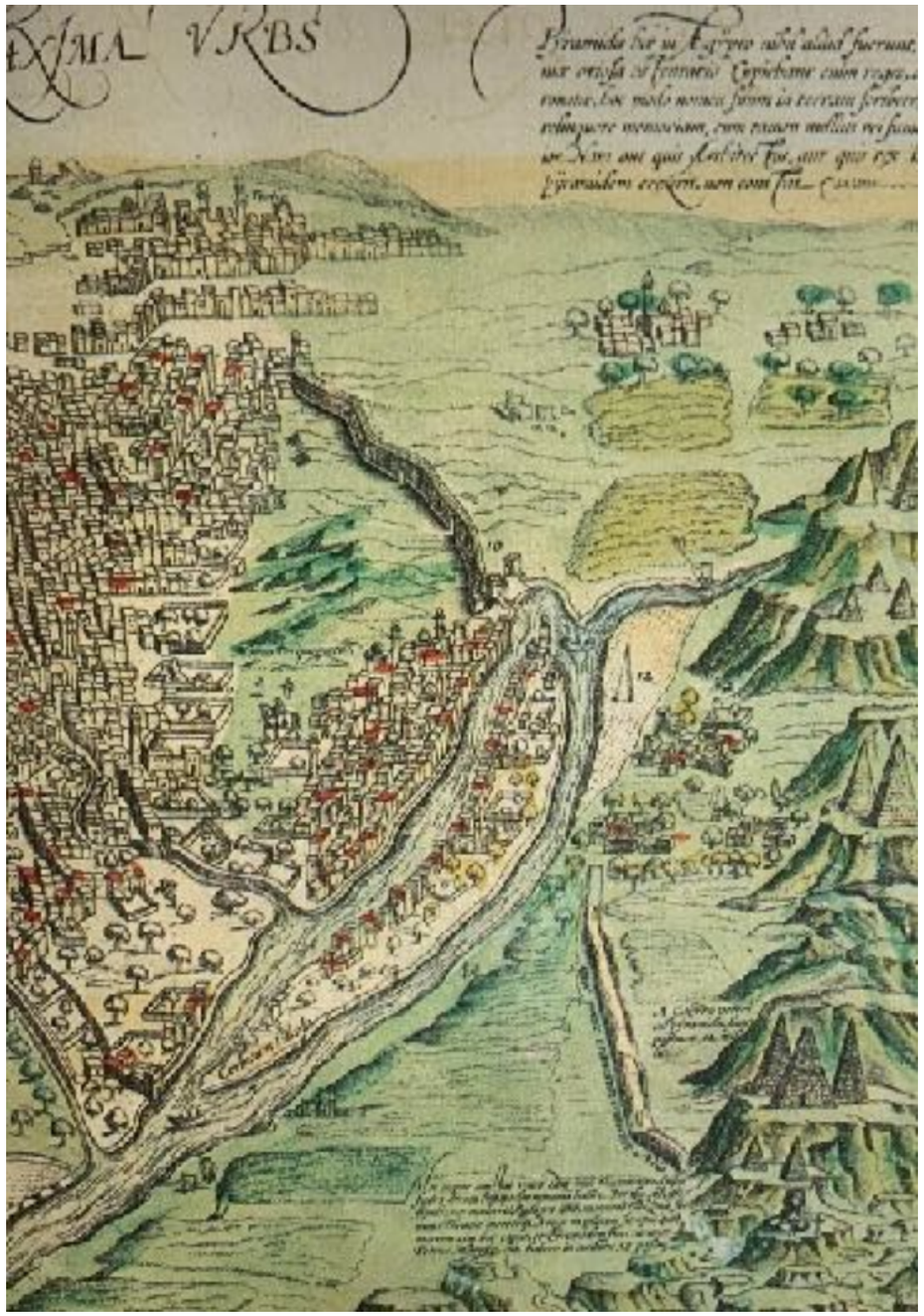
Volkoff, *1000 Jahre Kairo* (1984),

B2

This 16th-C German woodcut of Cairo shows no wind-catchers at all, and perhaps there is a mosque with dome and minaret in the upper left.

Described in Viktoria Meinecke-Berg, “Eine Stadtansicht des mamlukischen Kairo” (1976).

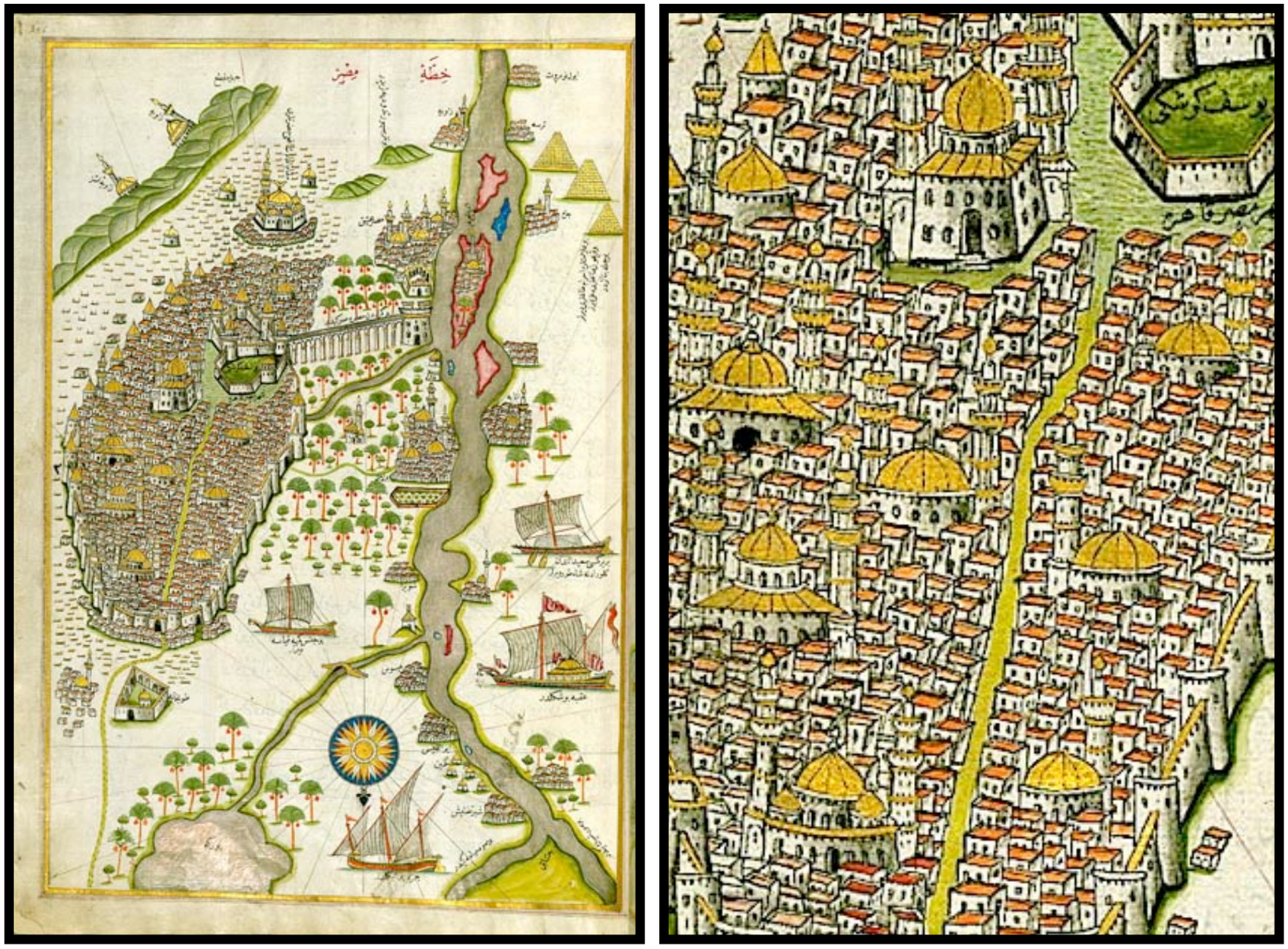
B3



A view of Cairo in the great city atlas (*Civitates orbis terrarum*) published in Cologne in 1572, prepared by Georg Braun and illustrated by Franz Hogenberg. This work contains views of 546 cities around the world. There are plenty of fake pyramids shown here, but again, no particularly Islamic features!

Volkoff, *1000 Jahre Kairo* (1984), betw. pp. 48 & 49.

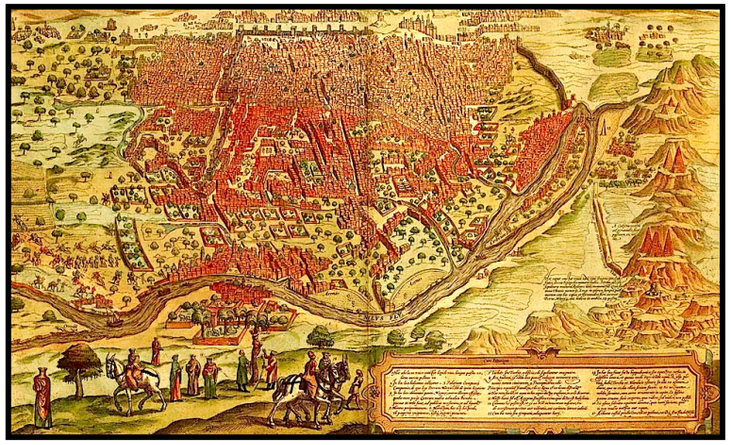
B4



In this representation of Cairo and a detail therefrom in the 1513 atlas of the Turkish scholar and navigator Pīrī Rē'is we see the three pyramids and some minarets but no wind-catchers.

Kathryn Moench, "Built form during the Mamlūk Sultanate" (2015), p. 59.

Matteo Pagano (fl. 1538-1562) published this bird's eye view of Cairo.

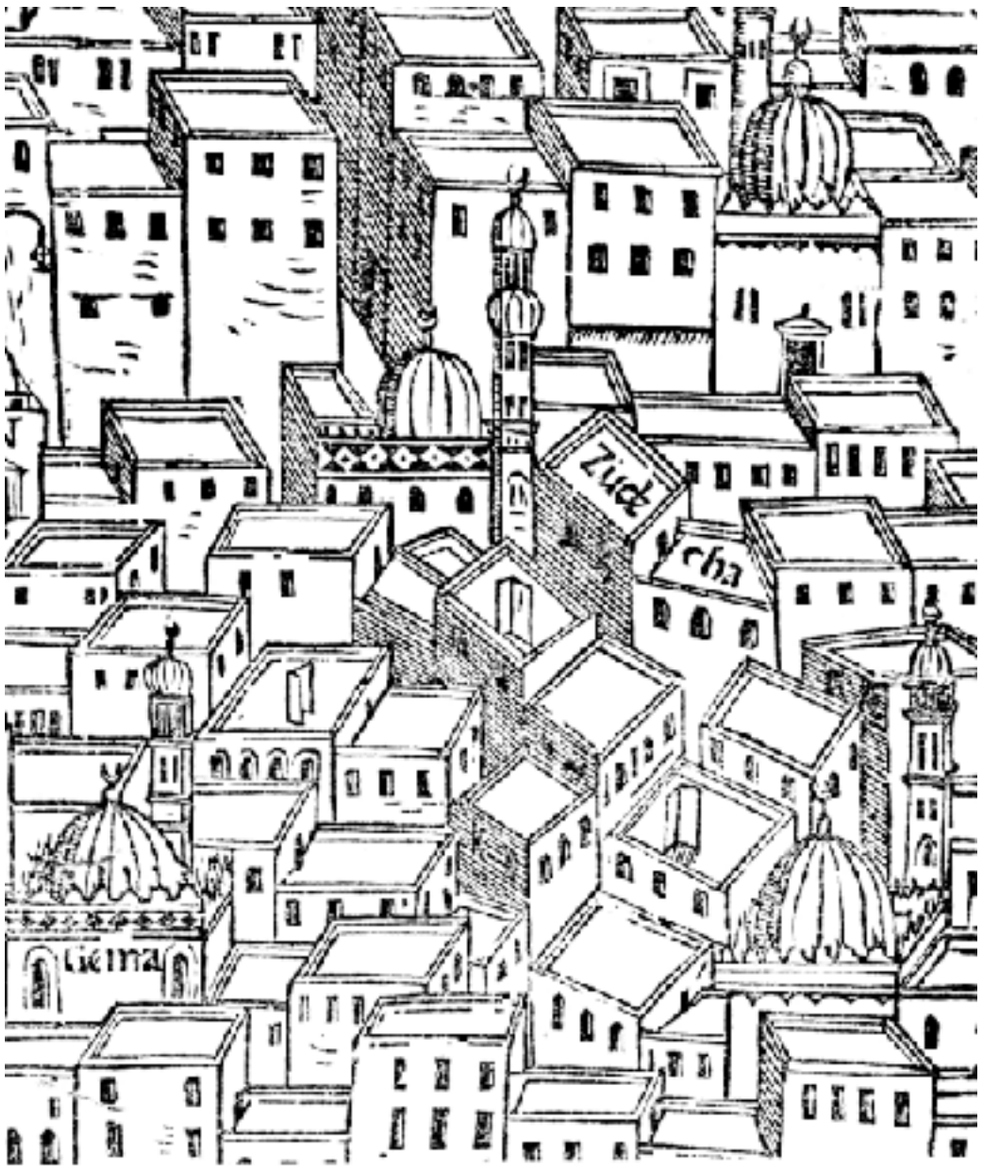


A detail of the view of Cairo by Matteo Pagano & Giovanni Domenico Zorzi. 16th-C woodcut.

Domes and minarets highlighted by K. Moench. I would have highlighted the wind-catchers if I had seen any.

Both images from Kathryn Moench, "Built form during the Mamlūk Sultanate" (2015), p. 45.

B6



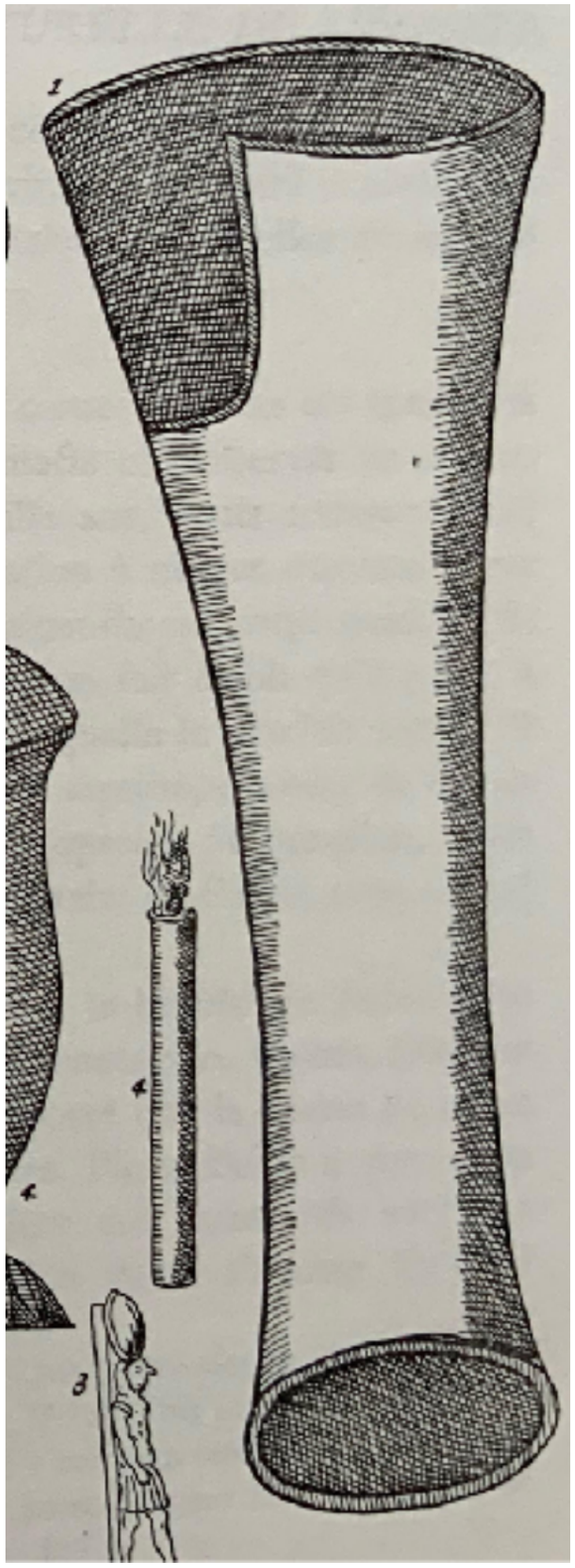
There are just three wind-catchers shown on rooftops in this extract from Pagano's woodcut of Cairo. They are standing vertically like double-panel room-dividers, with the panels partially open to achieve stability. They are inevitably open toward three different directions.

This is the earliest-known pictorial representation of the Cairo wind-catchers. A "truer" display might have shown wind-catchers on all but three of the houses, but this is certainly not bad for a start.

This image was kindly made available by Nicholas Warner, author of *The Monuments of historic Cairo* (2015), and *The True Description of Cairo – A 16th-century Venetian view* (2006).*

*** A summary is in www.arcadian-library.com/study-series-no-2.php.**

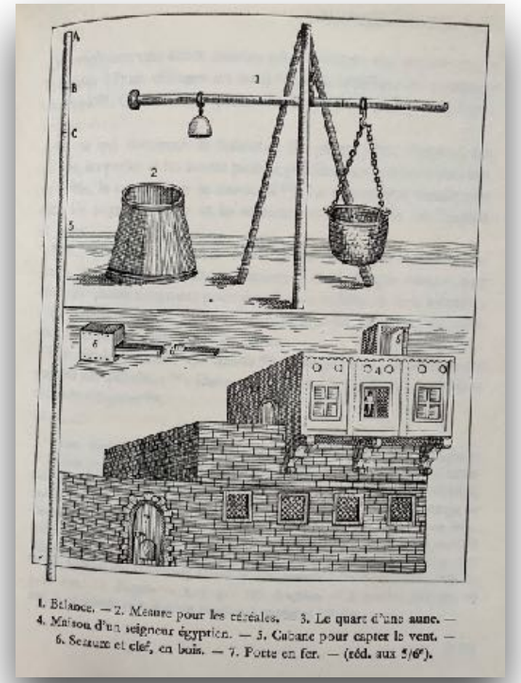
B7



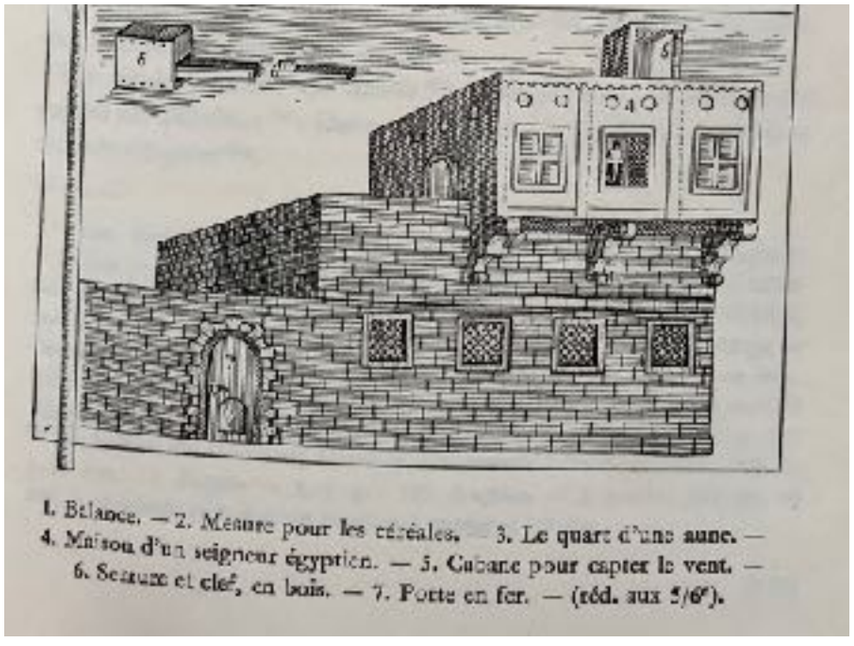
The physician and botanist Prospero Alpini (1553-1617) from the Republic of Venice spent three years in Cairo. He mentioned the wind-catchers, stating that the Cairenes used "vast ducts, similar to large trunks situated in the interiors of all the houses to receive the cold air." Sometimes these were made of wood, he says. His splendid illustration of such a duct is fairly explicit, if totally inaccurate.

Alpin, *Voyage en Égypte*, 1980 edn., IV, pl. 1 on p. 35.

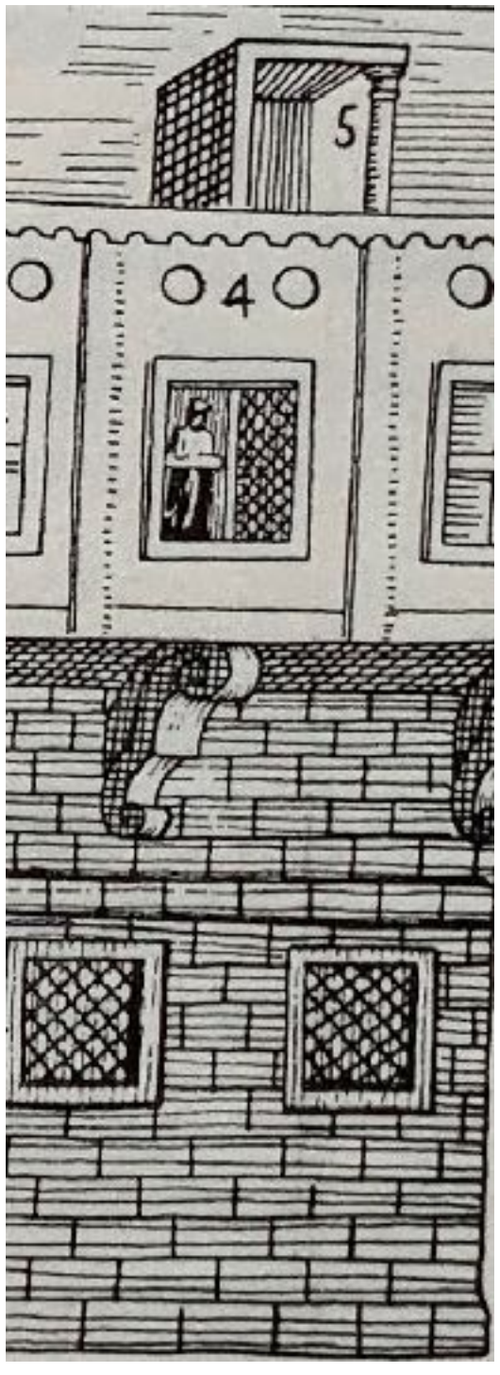
B8



1. Balance. — 2. Mesure pour les céréales. — 3. Le quart d'une aune. — 4. Maison d'un seigneur égyptien. — 5. Cabane pour capter le vent. — 6. Serrure et clef, en bois. — 7. Porte en fer. — (réd. aux 5/6e).



1. Balance. — 2. Mesure pour les céréales. — 3. Le quart d'une aune. — 4. Maison d'un seigneur égyptien. — 5. Cabane pour capter le vent. — 6. Serrure et clef, en bois. — 7. Porte en fer. — (réd. aux 5/6e).



A sketch in the travelogue of the Spanish priest Antonius Gonzales, who visited Egypt in 1665-66. It is obvious that he was well aware of the proliferation of wind-catchers in Cairo. His '*cabane pour capter le vent*', 'hut or cabin for catching the wind', with a horizontal roof corresponds essentially to the *bādahanj* on the complex of Muḥibb al-Dīn al-Muwaqqiʿ, dating from 1350 and still *in situ* – see Pl. Q3.

It is quite possible that the house with its windows is supposed to be facing north. Note that the left/east side of the wind-*cabane* is fitted with an open grid, and the right/west side appears to be open.

Gonzales, *Voyage en Égypte*, 1977 edn., p. 170.

B9

Le Voyage en Egypte d'Edward Brown

1673 - 1674

The Englishman Edward Brown spent the period 1673-74 in Egypt. He devoted much attention to the winds in Cairo in his travelogue but does not appear to mention the wind-catchers. The sketch on the cover of the 1974 French translation of his writings was added by the modern editors of a series of historical travel literature by Europeans visiting Egypt.

Please note: The images from the 19th and 20th centuries presented below do not in themselves constitute proof that the wind-catchers were present in Cairo in previous centuries. The evidence that they were omnipresent in Cairo from the 10th C onwards is provided by Egyptian astronomical texts from the 10th to the 17th C, by Egyptian poetry from the 11th to the 14th C, and by Muslim and European travellers' accounts from the 12th to the 19th C.
For details see Part I.

It's not what you look at that matters, it's what you see."
Henry David Thoreau (1817-1862)

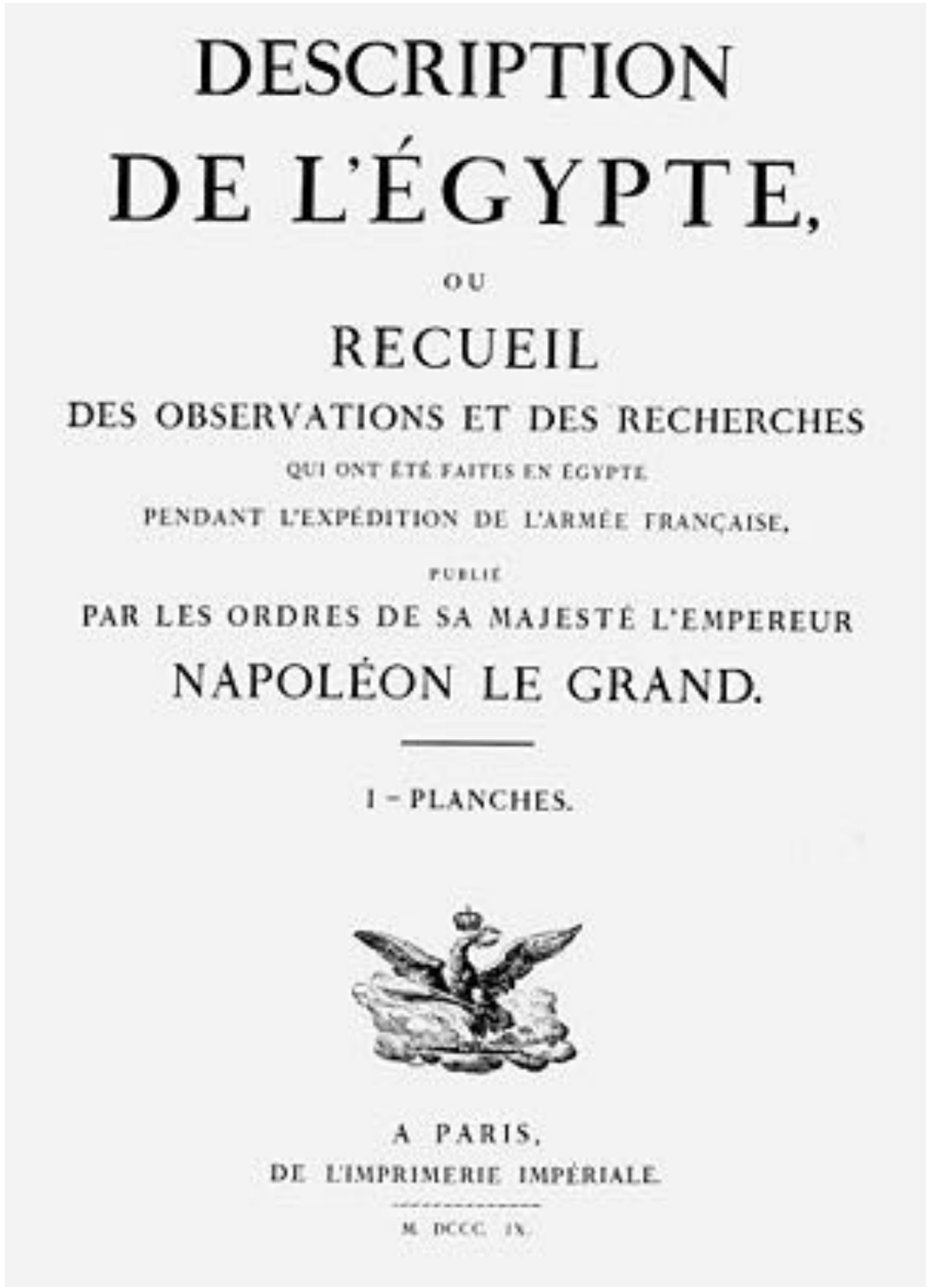
C

C: The *Description de l'Égypte* by the scholars of Napoleon *ca*. 1800

"The *Description de l'Égypte* is a work that constitutes a fertile field of investigation. Hidden away in the stacks of the great libraries as a work that is 'rare' or 'on reserve', this (enormous set of volumes) is waiting for researchers to join forces in order to study it with multidisciplinary vision."
Boussif Ouasti, "*La Description de l'Égypte*" (1990), pp. 81-82 (my translation).

" … that great collective appropriation of one culture by another. … " Edward Said.

C1


DESCRIPTION

DE L'ÉGYPTE,

OU

RECUEIL

DES OBSERVATIONS ET DES RECHERCHES

QUI ONT ÉTÉ FAITES EN ÉGYPTE

PENDANT L'EXPÉDITION DE L'ARMÉE FRANÇAISE,

PUBLIÉ

PAR LES ORDRES DE SA MAJESTÉ L'EMPEREUR

NAPOLÉON LE GRAND.

I - PLANCHES.

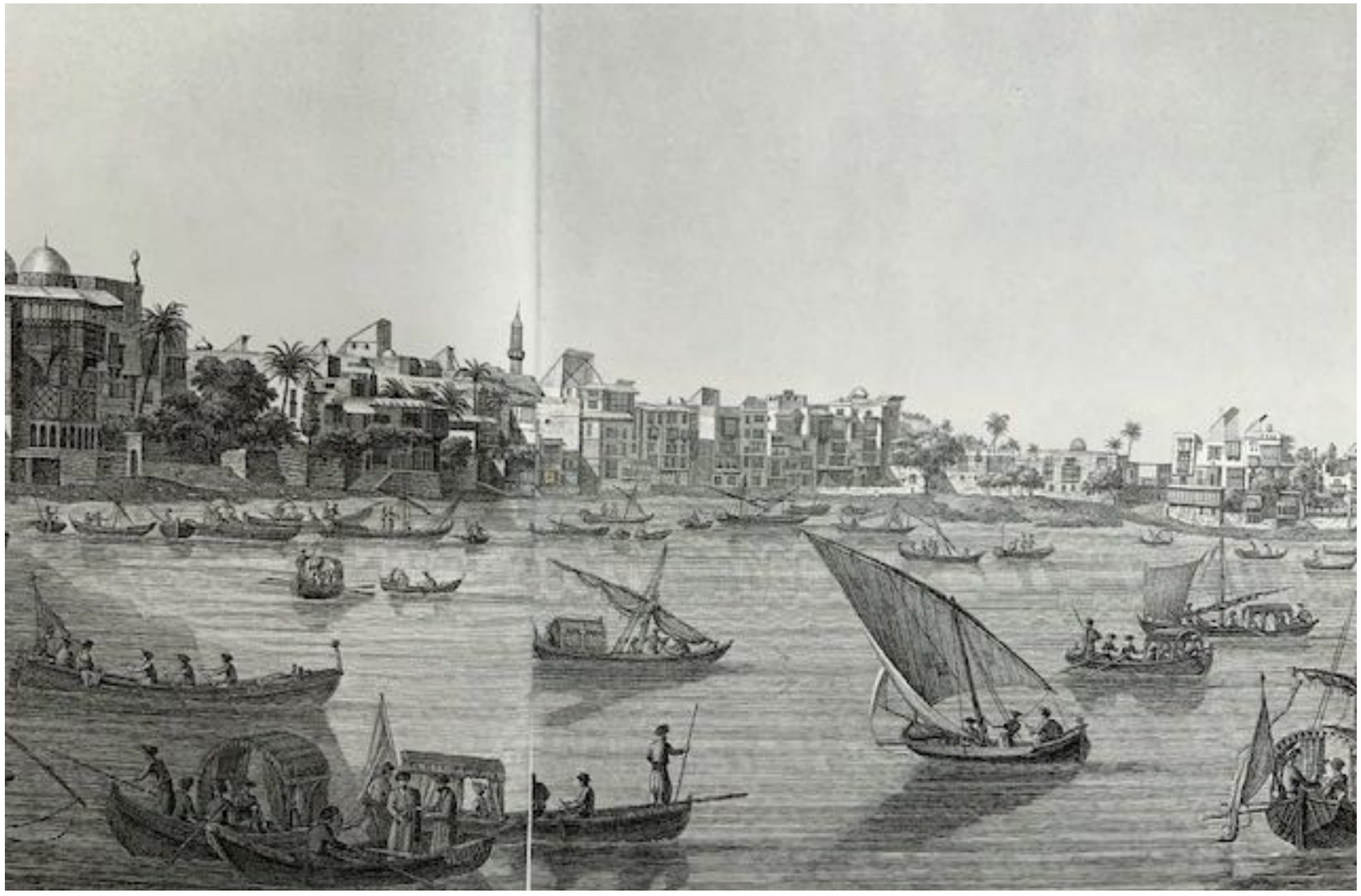
A PARIS,

DE L'IMPRIMERIE IMPÉRIALE.

M. DCCC. IX.

The sumptuous volumes of engravings and text in the *Description de l'Égypte* by the scholars of Napoleon represent the most valuable single pictorial source for the present study. The profusion of the wind-catchers that were a veritable symbol of the medieval city is still discernible, and some are shown that are three to four times as wide as the largest one that survived until the end of the 20th C, namely, that on the Musāfirkhāne (see Section R below).

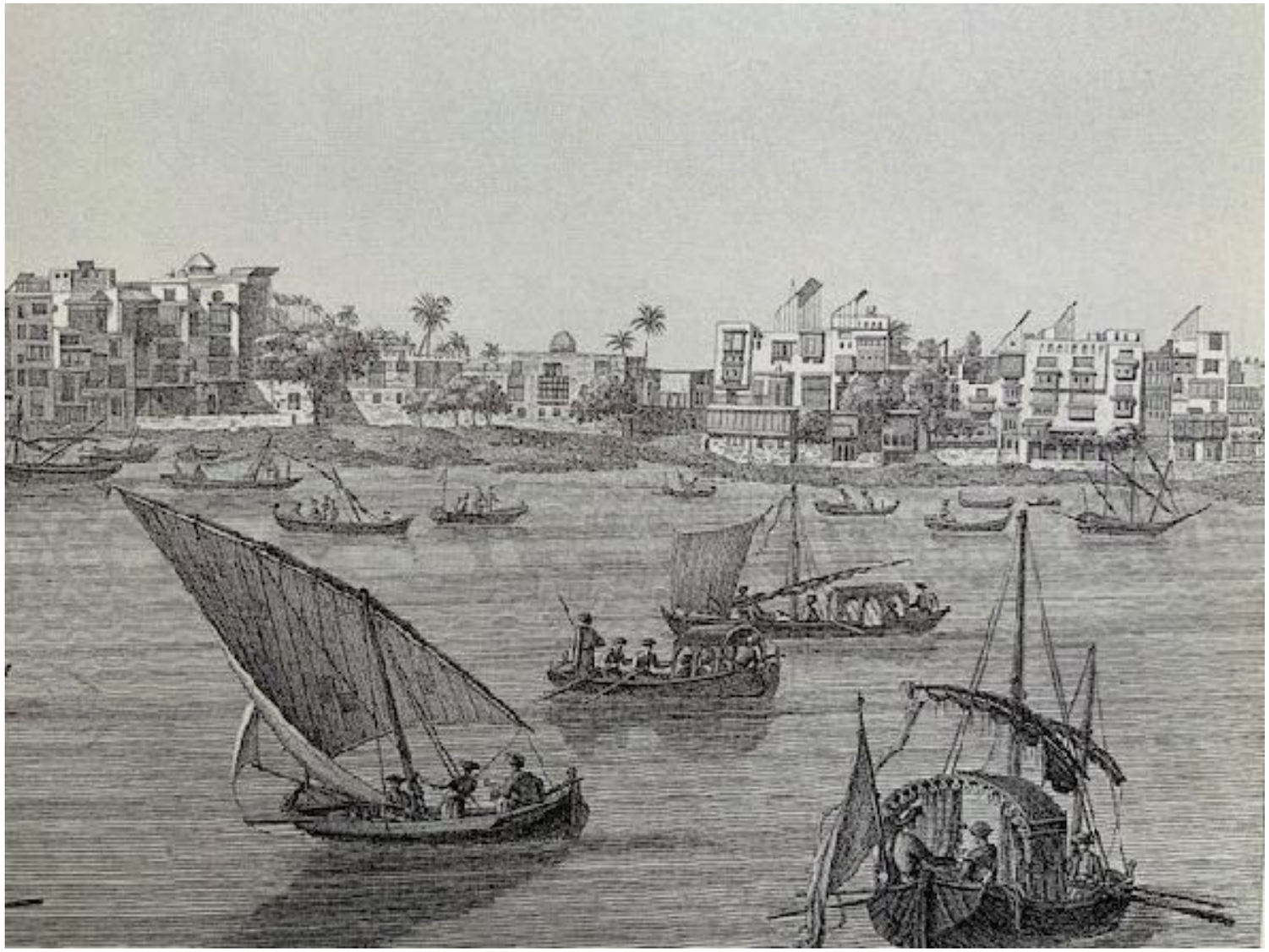
C2



The views from the east around the lake of Ezbekiyya formed by the annual flooding of the River Nile show wind-catchers on many of the houses facing roughly north. See also the next two images.

***Description de l'Égypte*, *État moderne,* I, pl. 41 / 608-609.**

C3



Detail of the previous image, with buildings shown on the western side of the lake and wind-catchers facing a northerly direction.

***Description de l'Égypte*, *É.M.*, I, pl. 41 / 609.**

C4

Another view of the lakeside, now facing west with the numerous wind-catchers are shown facing a northerly direction.

***Description de l'Égypte*, *É.M.*, I, pl. 42 / p. 610.**

C5

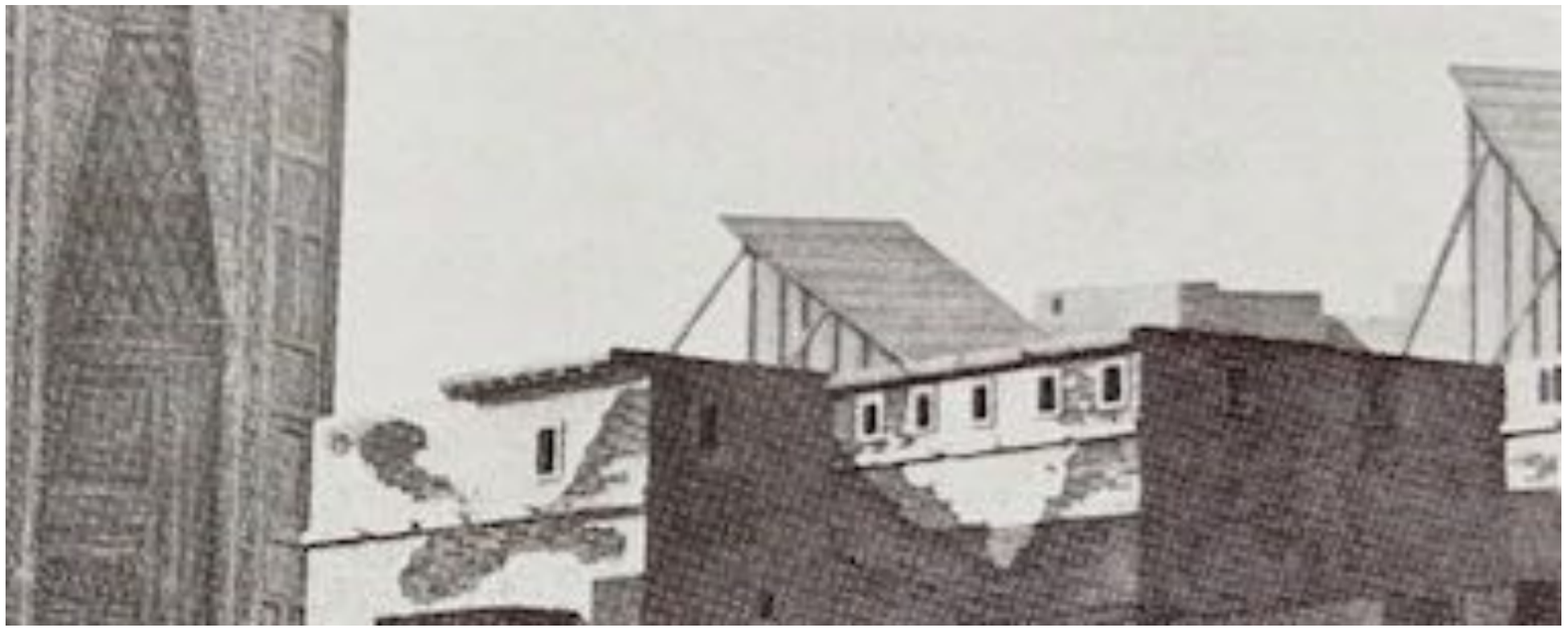
**A detail of houses on the western side of the lake,
with wind-catchers facing northerly direction.**

***Description de l'Égypte*, *É.M.*, I, pl. 43 / 612.**

C6

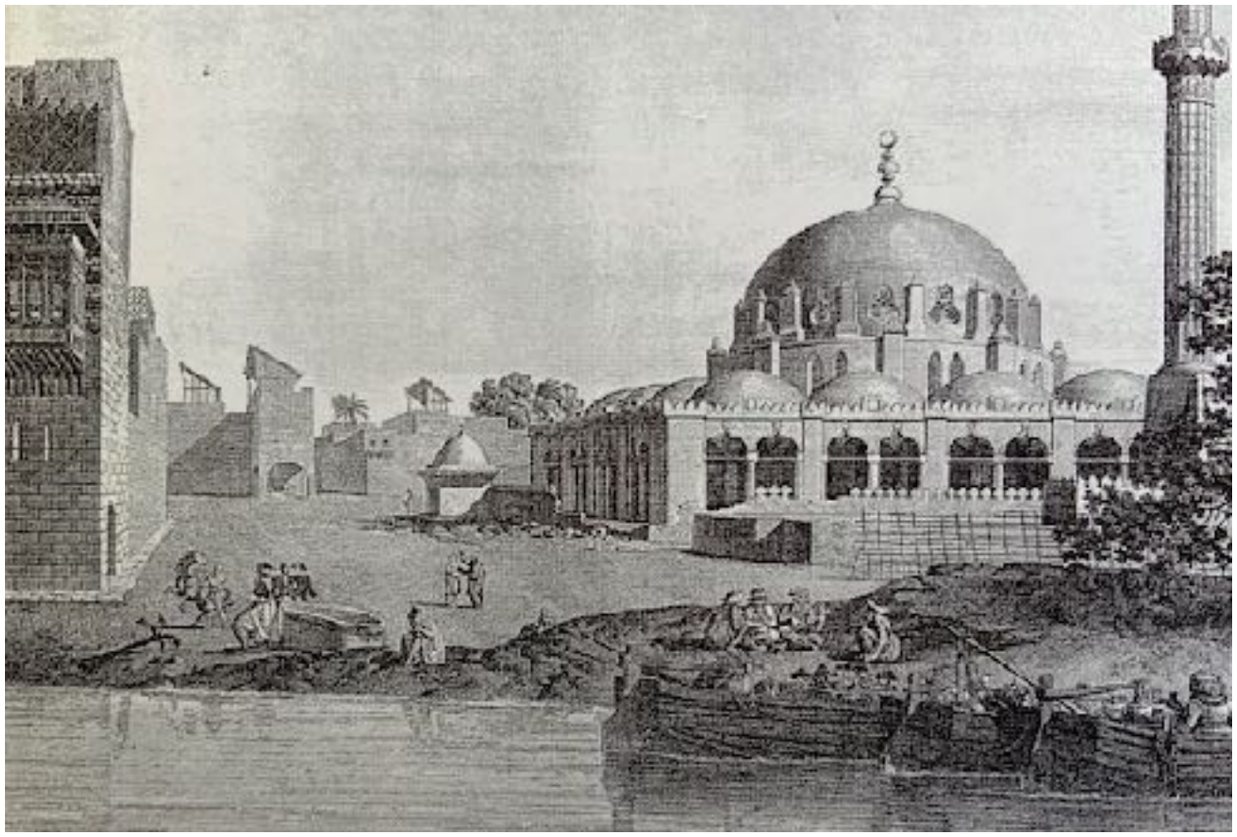
Two large wind-catchers near the front portal of the Sultan Ḥasan Mosque.

***Description de l'Égypte*, *É.M.*, I, pl. 38 (details).**



"Just as I love my beloved and my beloved loves me, I love the cool air of the *bādahanj*, and the *bādahanj* should reciprocate by constantly attracting cool air."
The poet Ibn Abī Ḥajala at-Tilimsānī, writing in Cairo *ca*. 1360.

C7

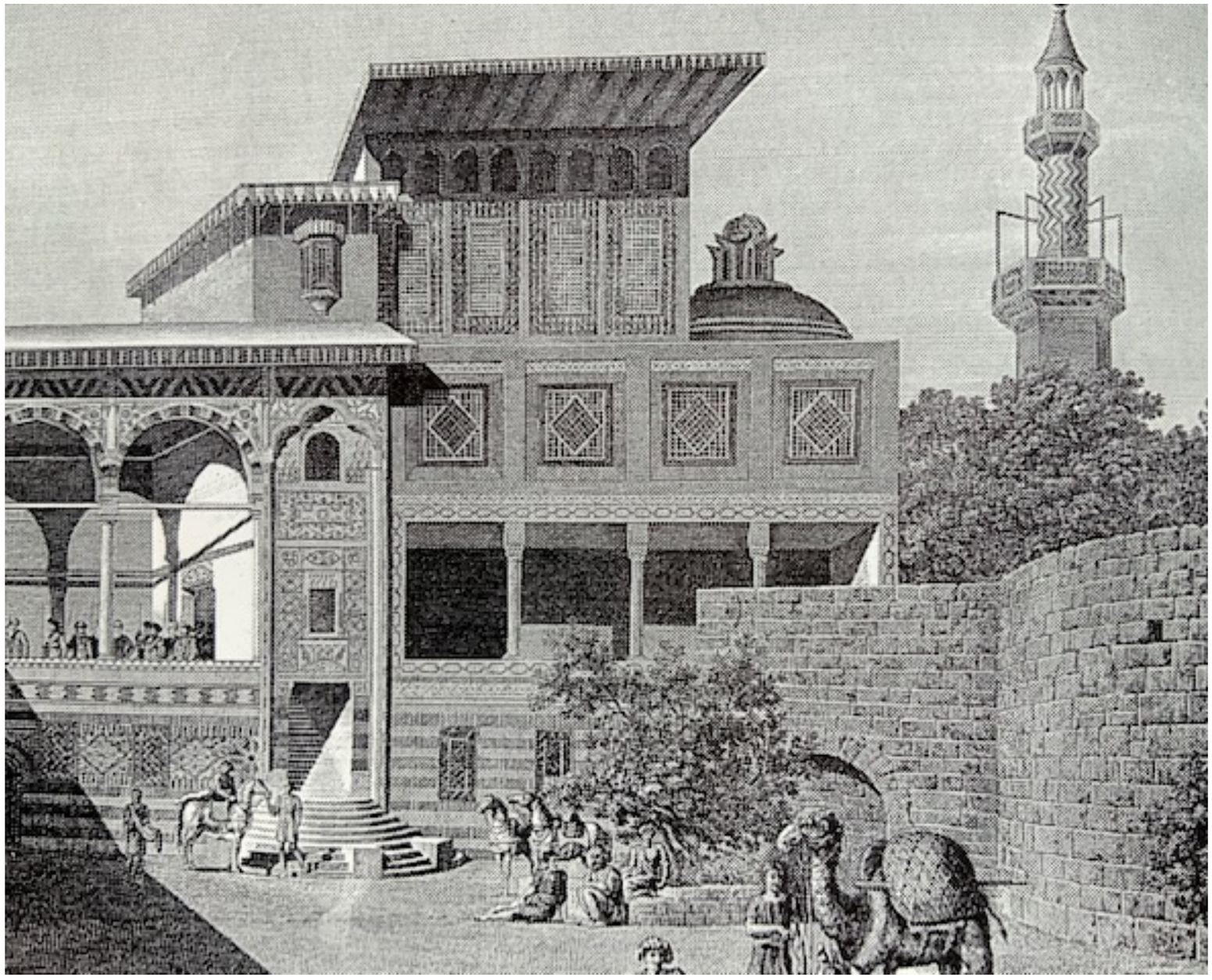


A view of the port of Bulaq and the main mosque, with three wind-catchers visible in the background. The artist has shown the two on the right with one side open to the east and the one on the left with its eastern side somehow blocked off.
A reminder: according to medieval prescriptions, the western side should be open.

***Description de l'Égypte*, *É.M.*, I, pl. 25 / 590.**

S. Rappoport, *History of Egypt*, vol. 12 (1905), fig. 190,

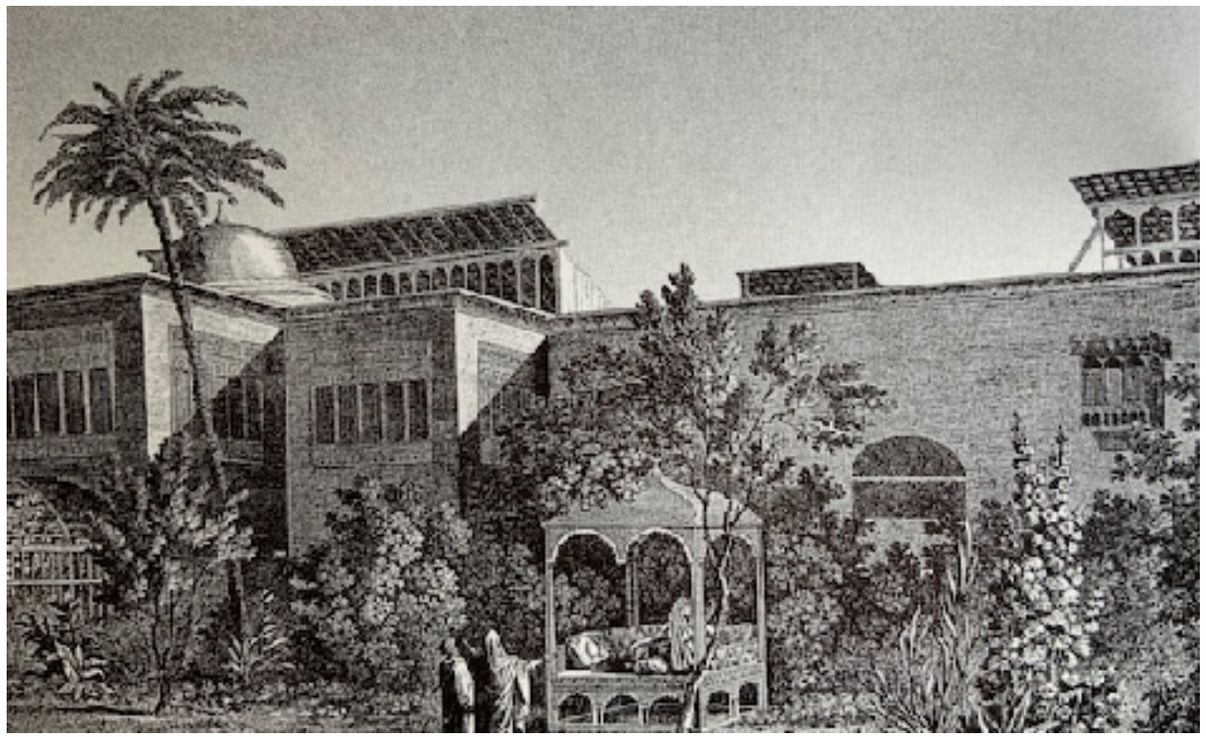
C8



The large exterior courtyard of the house of ʿUthmān Bey is dominated by a splendid and very large wind-catcher with fine decorative screening.

***Description de l'Égypte*, *É.M.*, I, pl. 50 / 620.**

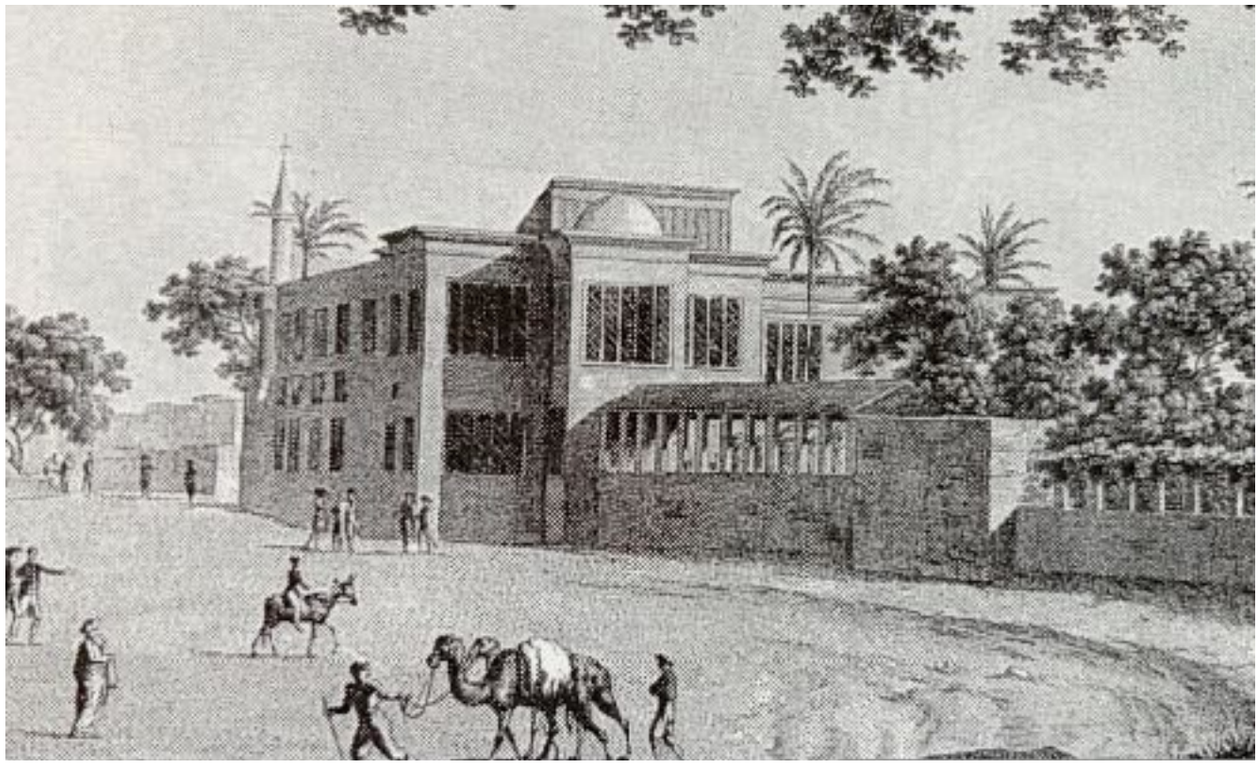
C9



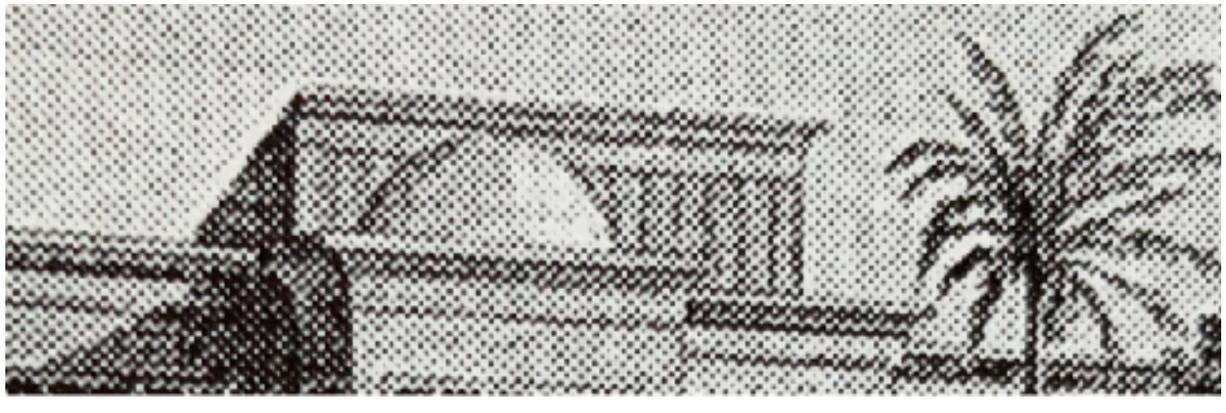
Three enormous wind-catchers on the roof of the Palace of Alfī Bey. The one on the left is three to four times as wide as the one which graced the Musāfirkhāne. The one on the left seems to have the right / western side closed. The one on the right has the left / eastern side open.

Either the architects had forgotten about the medieval prescriptions or the artist was not aware that such details of the design were important.

***Description de l'Égypte*, *É.M.*, I, pl. 52 / 622.**



Another view of the enormous wind-catcher behind the dome on the roof of the Palace of Alfī Bey. The owner fled to Upper Egypt when the French invaded. The building was taken over as the General Headquarters of the French Army, and later suffered the further indignity of being replaced by the first Shepheard's Hotel.



***Description de l'Égypte*, *É.M.*, I, pl. 40 / 607.**

"Shepheard's Hotel, Cairo: a little piece of England."

https://paintingthenile.wordpress.com/2016/08/04/shepheards-hotel-cairo-a-little-piece-of-england/

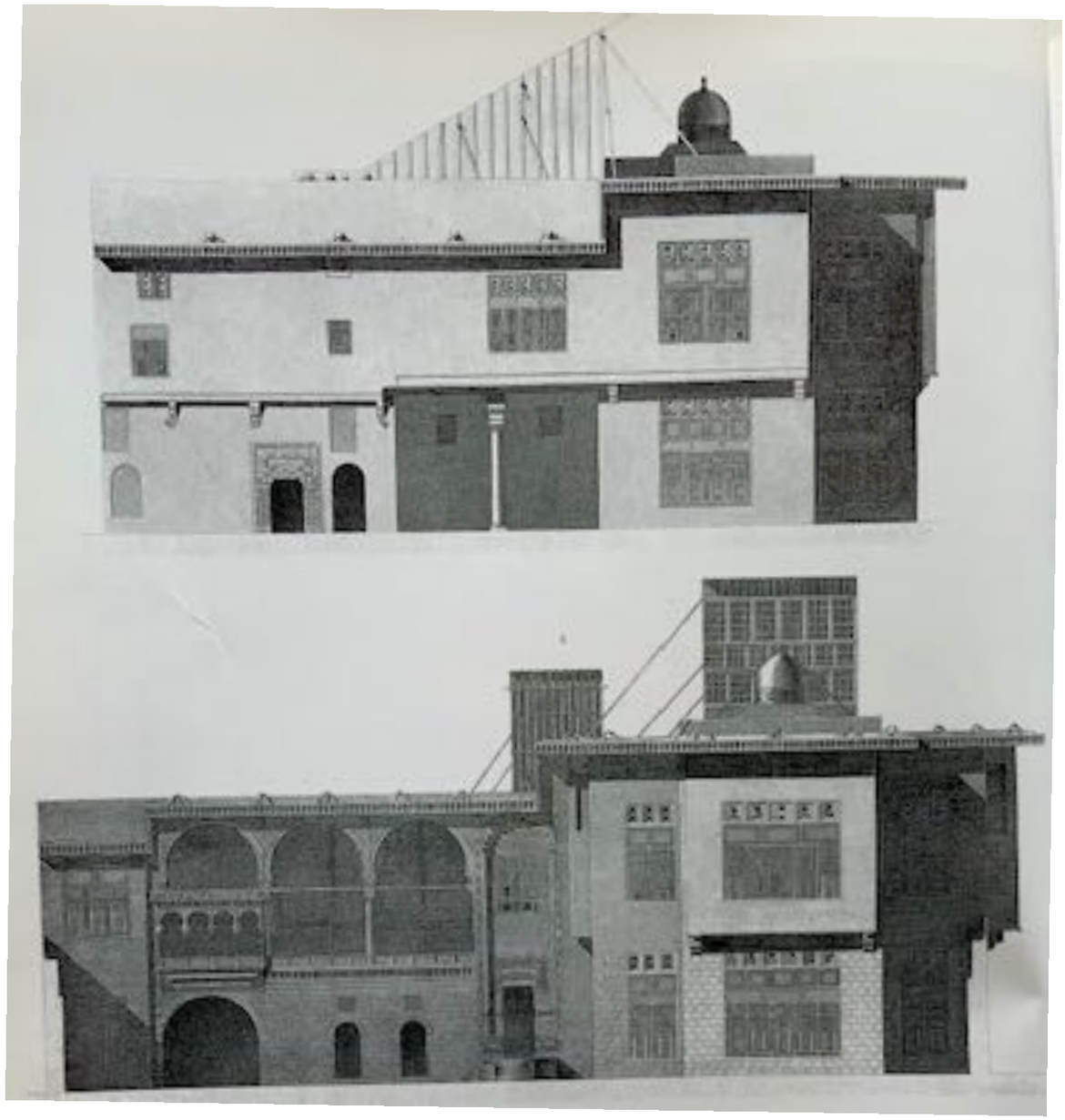
C10a

A view of Old Cairo, engraving by Baltard after a drawing by Conte. Notice the three substantial wind-catchers in the distance.

***Description de l'Égypte*, *É.M.*, I, pl. 18 / 583, also**
www.gettyimages.dk/detail/news-photo/view-of-old-cairo-egypt-engraving-by-baltard-after-a-news-photo/1144550083.

C11

Illustrations of the Palace of Ḥasan Kāshif, with side view and frontal view of decorated wind-catchers.

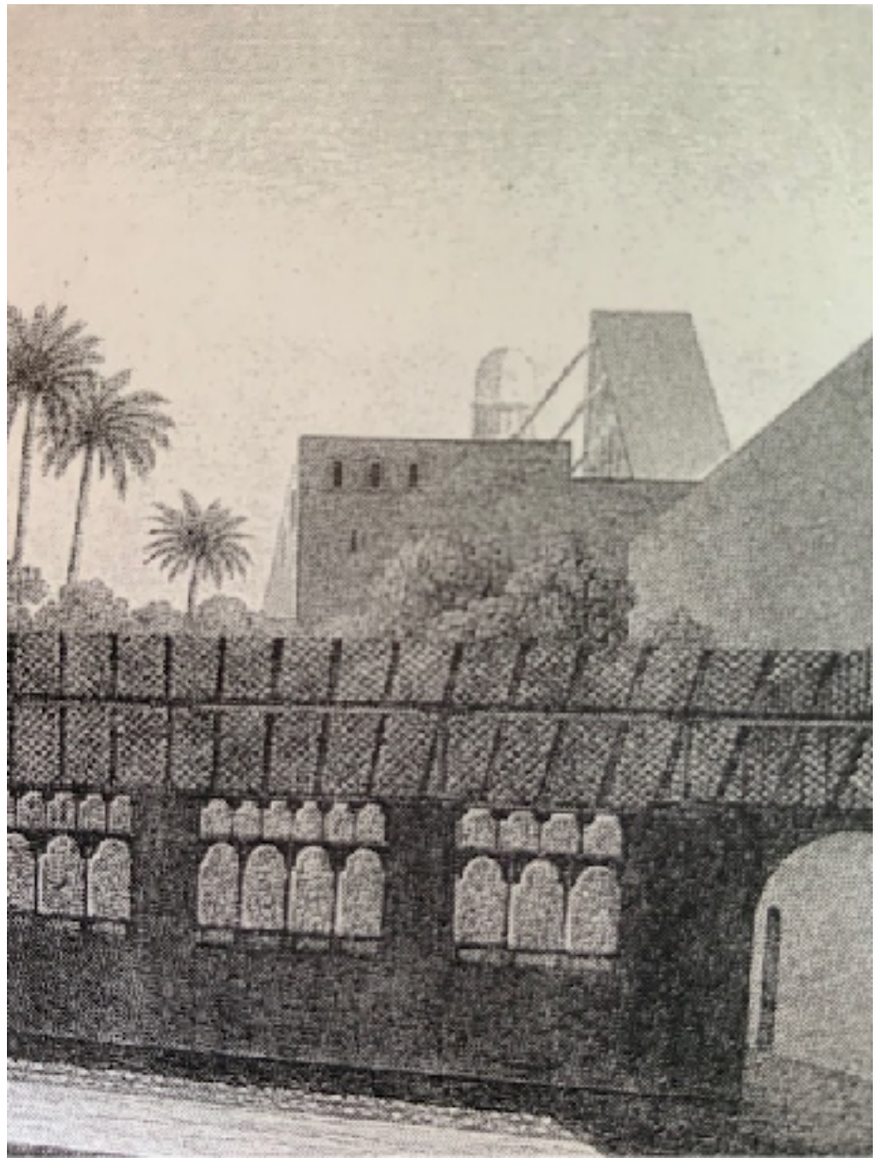


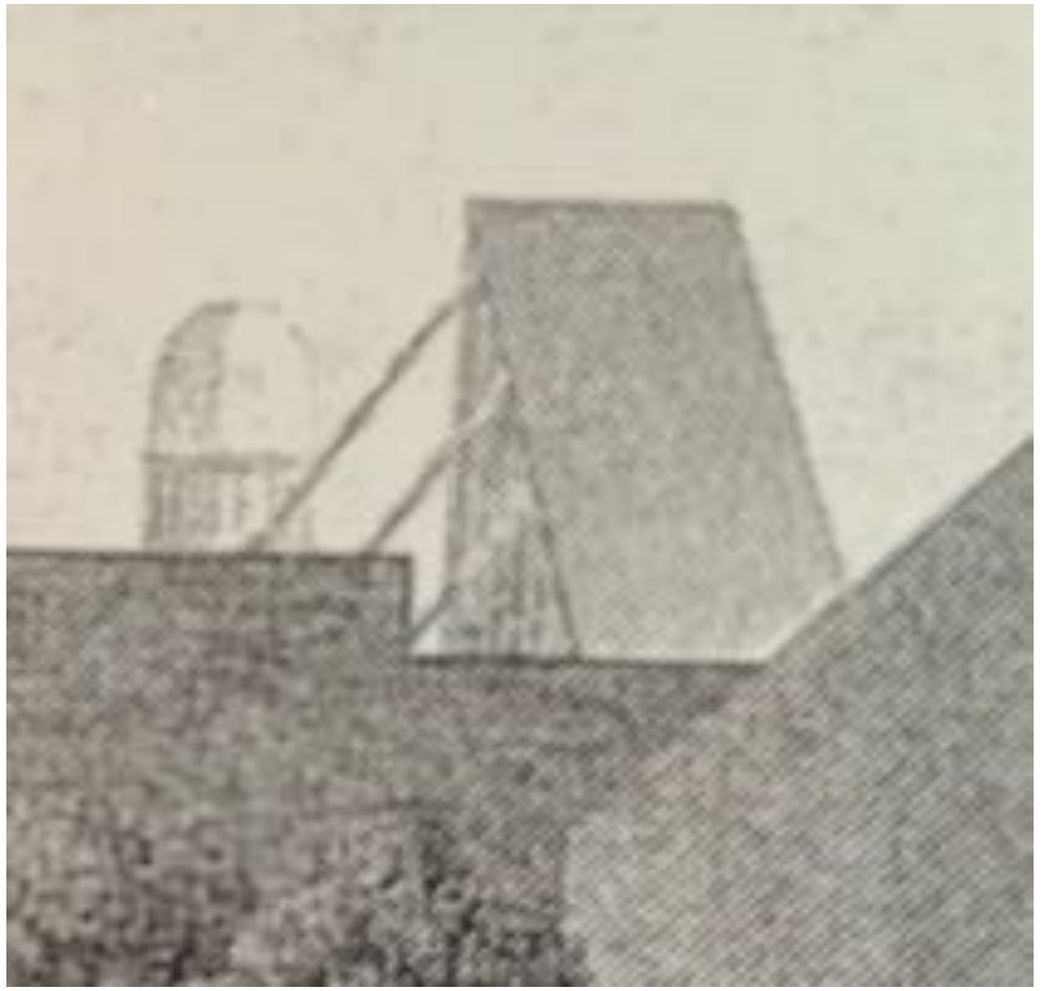
“If ... local methods do not provide all that is needed in an age of change and activity, they are at any rate, though perhaps curiously, adapted to the physical conditions of the country; and an architect will lose nothing by studying them respectfully.” Ernest Tatham Richmond (1874-1955), sometime Director of Public Buildings for Egypt, addressing the Royal Institute of British Architects in 1911 on the subject of indigenous Egyptian building techniques.

**“Don’t sleep in the *bādahanj*
For there is no medicine for those made sick by it.
The individual that steals passion (air)
At night is not safe.”
The poet Ṣadr al-Dīn Ibn ʿAbd al-Ḥaqq,
Cairo, d. *ca*. 1380**

***Description de l’Égypte*, *É.M.*, I, pl. 54 / 624.**

C12

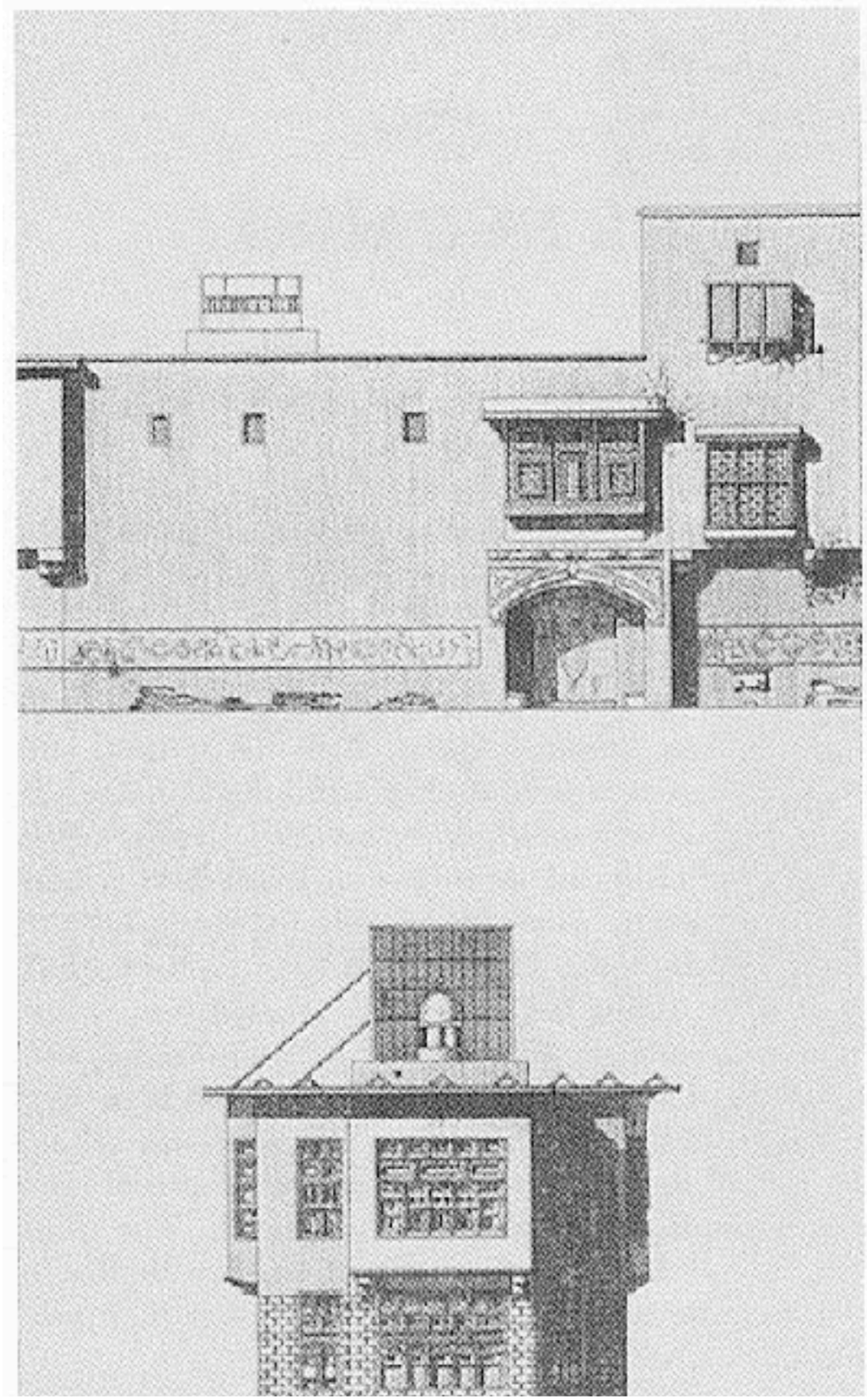


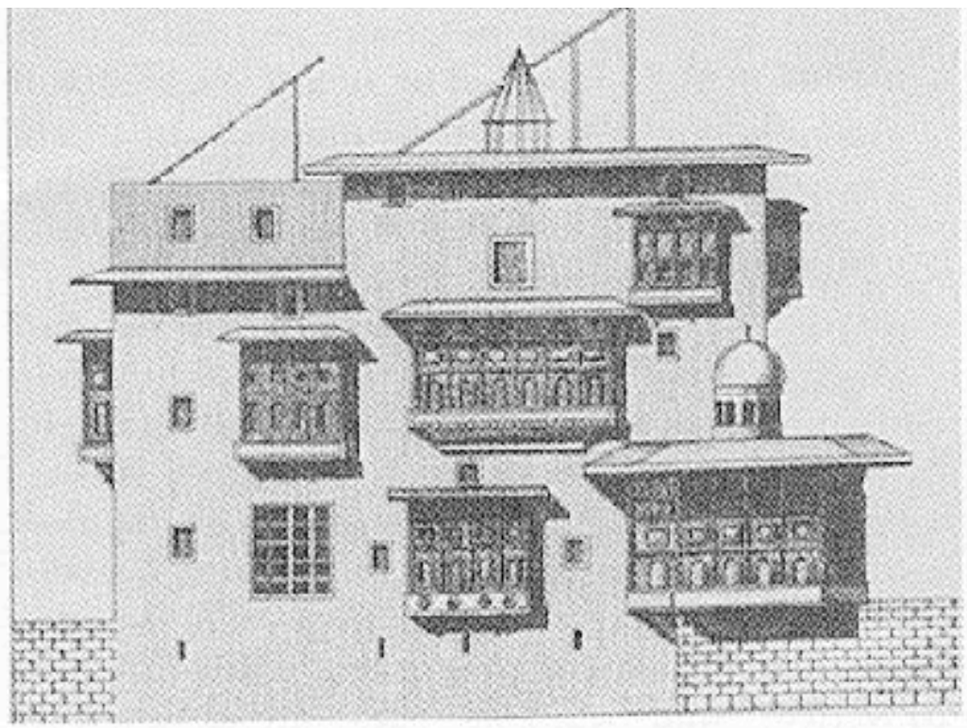


A substantial wind-catcher with roof / roofs elevated at about 70°. Or could it be that we have here a sole example of a "winged" (مجنح , *mujannaḥ*) *bādahanj*, as mentioned in the astronomical texts? The scene is a detail from a view from the Palace of Ḥasan Kāshif, with the wall of the the court-yard shown in the foreground on the left.

***Description de l'Égypte*, *É.M.*, I. pl. 56 / 626.**

C13

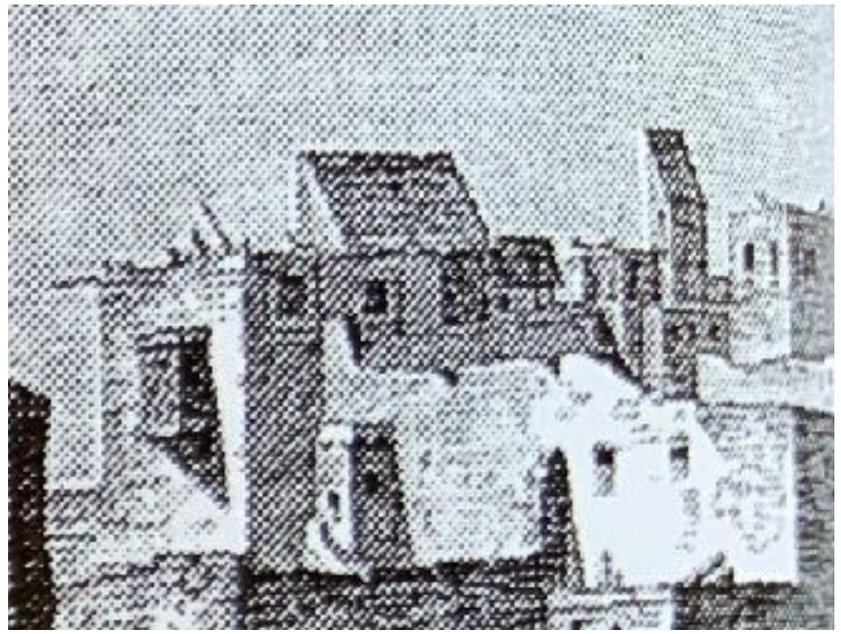




Three designs of Cairene houses. Each one has some kind of wind-catcher on the roof. Wind-catchers were important in Cairo, not only in Ottoman times (because they were not introduced by the Ottomans) but already in Fatimid and Mamluk times, in other words, from the 10th to the 19th C.

***Description de l'Égypte*, *É.M.*, II, pl. 102 / 681.**

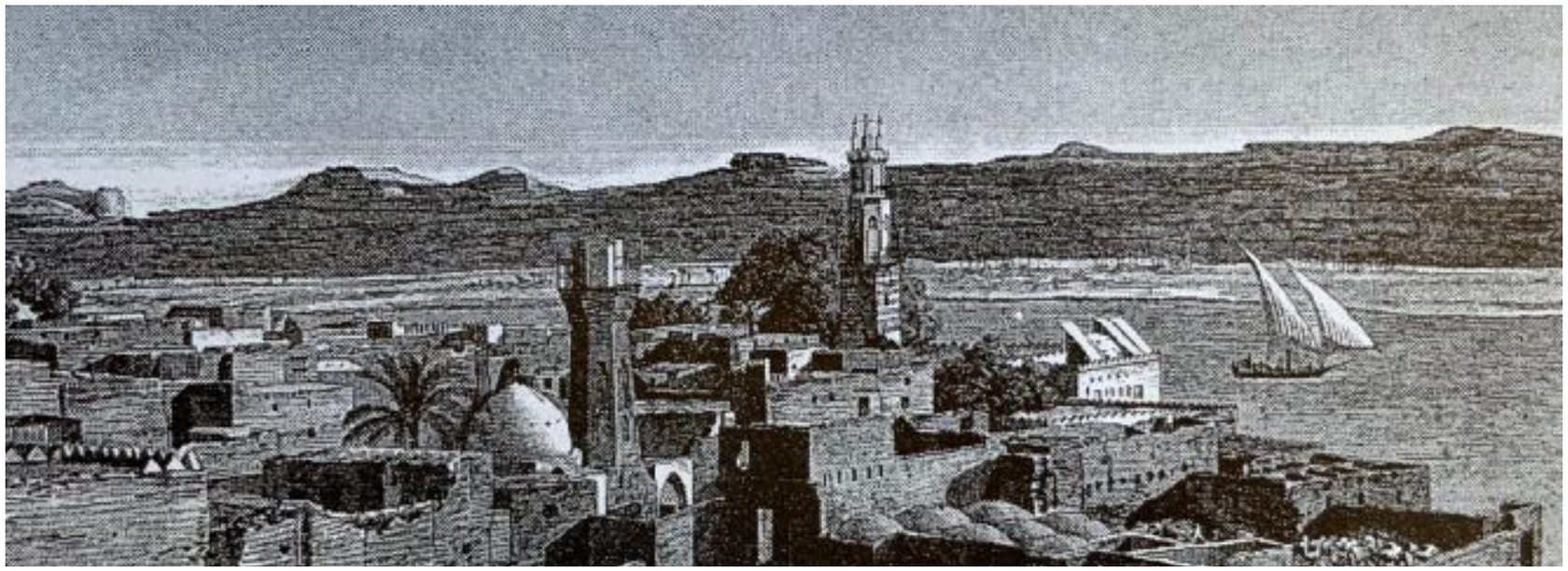
C14

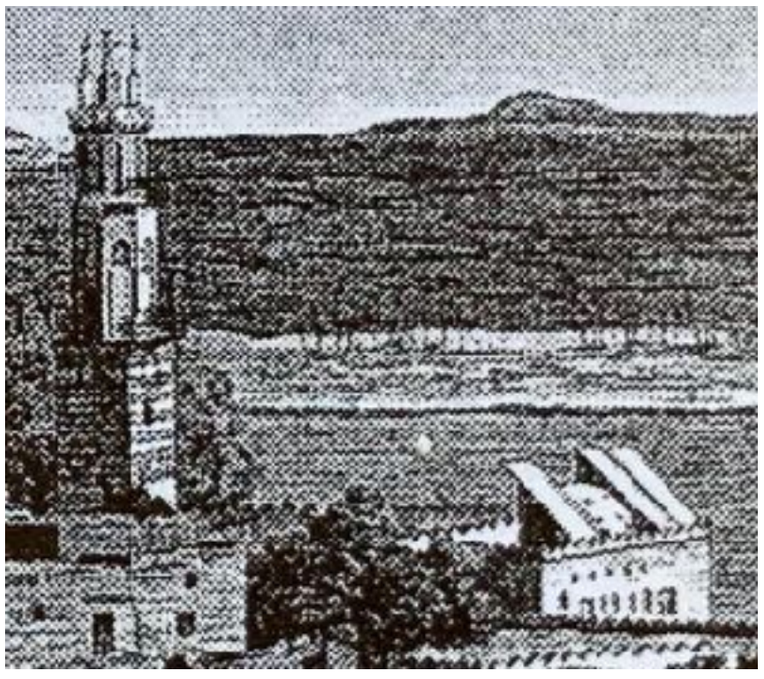


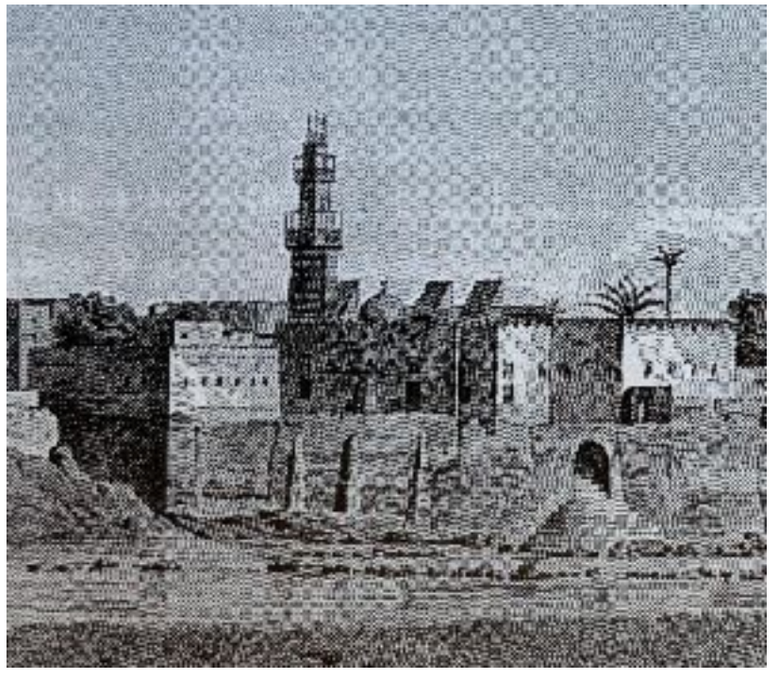
Farmers in fields outside the city. Two substantial wind-catchers can be seen on the roofs of the buildings to the right. The one on the furthest right is built atop a tower, unlike all of the others featured in our sources. Such details have been included by Olivier Jaubert in his 1995 typology of the Cairene wind-catchers.

***Description de l'Égypte*, *É.M.*, II, pl. XXIX / 714.**

C15



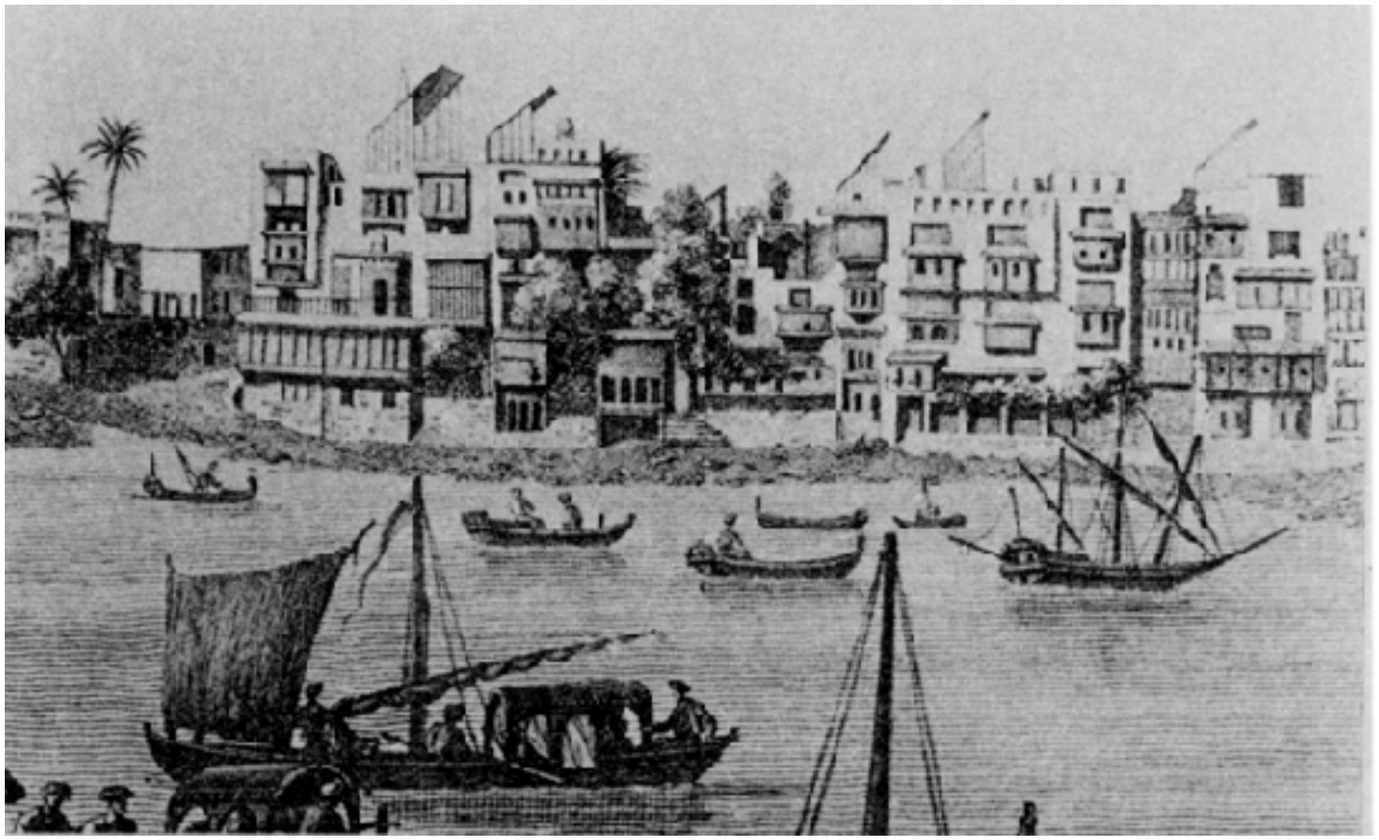




Two views over Minya showing a mosque or palace by the Nile with three wind-catchers.

***Description de l'Égypte*, *É.M.*, I, pls. 4-5 / pp. 565-566.**

C16



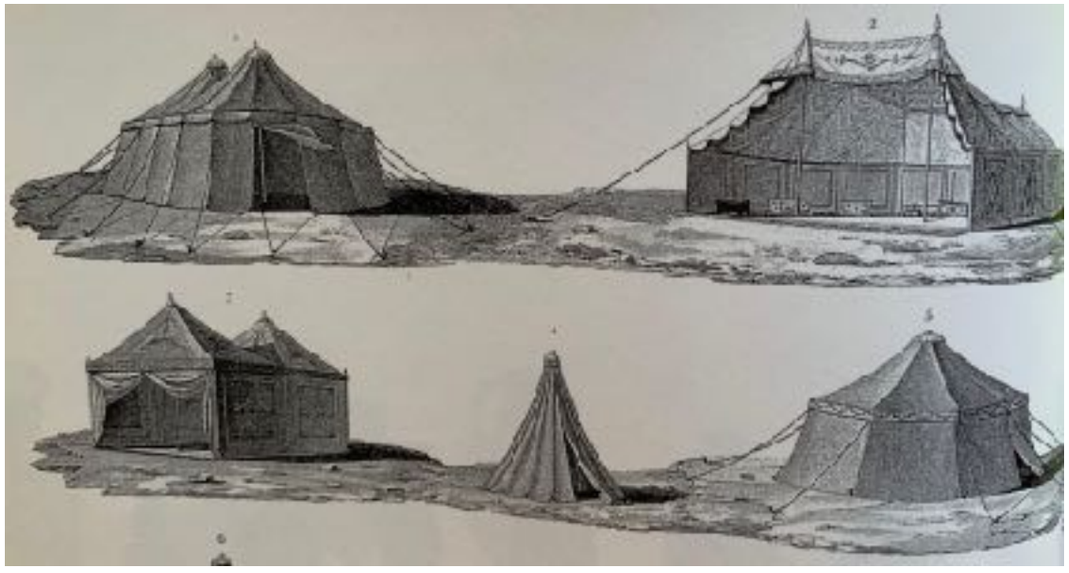
This image, supposedly featuring houses along the Nile, appeared in the article on Islamic vernacular architecture by Guy Petherbridge in 1978 with no provenance. I included it in my 1984 study of the Cairo wind-catchers and wrongly suggested that it represented a view of part of the medieval city from across the *Khalīj* or Red Sea Canal, which defines the western boundary of the old city. The wind-catchers, I maintained, are facing north, so that the image must be reversed. This hypothesis was confirmed by Elfriede Knauer in her discussion of Roman wind-towers. In fact, however, the image is a detail of an image from the *Description de l'Égypte* and the water is the lake of Ezbekiyya. Furthermore, the people enjoying an outing in the boats are not Egyptians. The detail represents some 5% of the full image in *D.E.*, *É.M.*, vol. I, pl. 41 / 609!

C17

A woman's garment, perhaps of the type called *bādahanj* in medieval Egyptian Arabic.

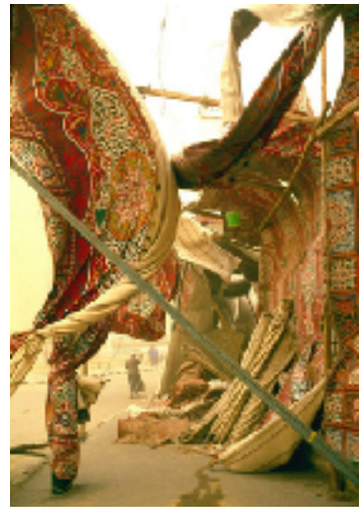
The tents below on the lower left and on the upper right may be of the kind known as خرقة , *kharqa*, in a medieval Egyptian poem, where they are likened to the *bādahanj*.

***Description de l'Égypte*, *É.M.*, II, pls. LL & GG.**



Or maybe these tents called *surādiq* erected for the Sufi *mawlid al-Aḥmadī* are more like a *bādahanj*?

Margoliouth, *Cairo* … (1912), p. 174, also www.dur.ac.uk/tentmakers/religious/



www.travelandleisure.com/slideshows/how-to-have-a-hurricane-proof-vacation?slide=111519#111519

D: Other French artists

“Orientalist paintings and other forms of material culture operate on two registers. First, they depict an “exotic” and therefore racialized, feminized, and often sexualized culture from a distant land. Second, they simultaneously claim to be a document, an authentic glimpse of a location and its inhabitants … … .” Nancy Demerdash, “Orientalism” (2015).

The Orientalist engravings and paintings in Sections C-F, which are neither racialized nor sexualised, are most certainly to be considered as historical documents, authentic glimpses of a location and its inhabitants. The Cairo wind-catchers were, however, eroticised by medieval Egyptian poets. DAK

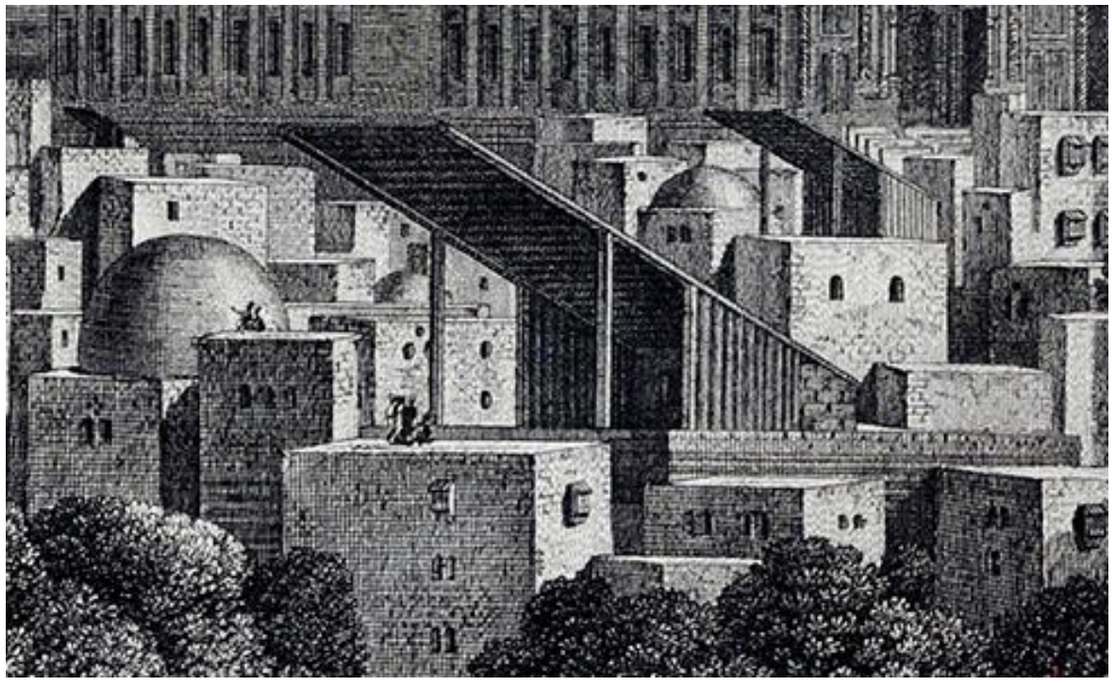
“I wholeheartedly love your abundant flow of air,
and my desire for the refreshing air makes me stick close to you.
There is nothing and nobody that could make me budge from your place.”
The poet Burhān al-Dīn al-Qīrāṭī, writing about the *bādahanj* in Cairo *ca*. 1350.

D1

Louis-François Cassas (1756-1827) was a distinguished French landscape painter, sculptor, architect, archaeologist and antiquary. He visited Egypt in late 1785 and published close to 200 images of various Middle Eastern countries in 1799. His magnificent representation of the Mosque of Sultan Ḥasan shows numerous houses in the foreground with substantial, perhaps exaggerated wind-catchers on their roofs. See the next images for details.

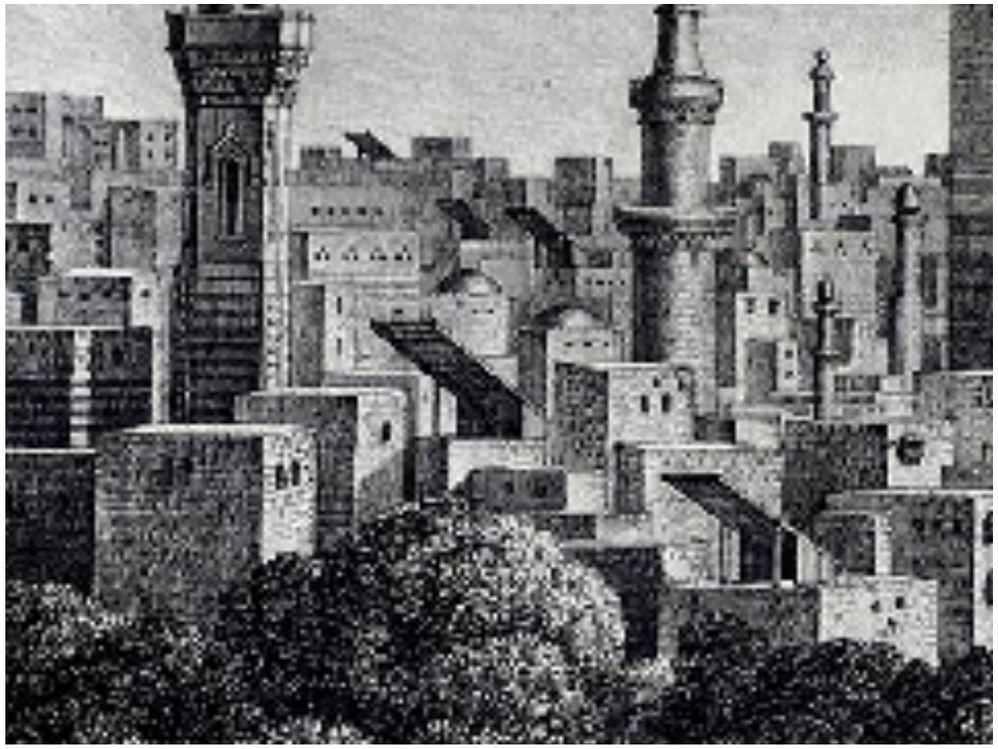
www.abebooks.fr/edition-originale/Voyage-Pittoresque-Syrie-Phoenicie-Palestine-Basse-Egypte/19310413886/bd.

D2

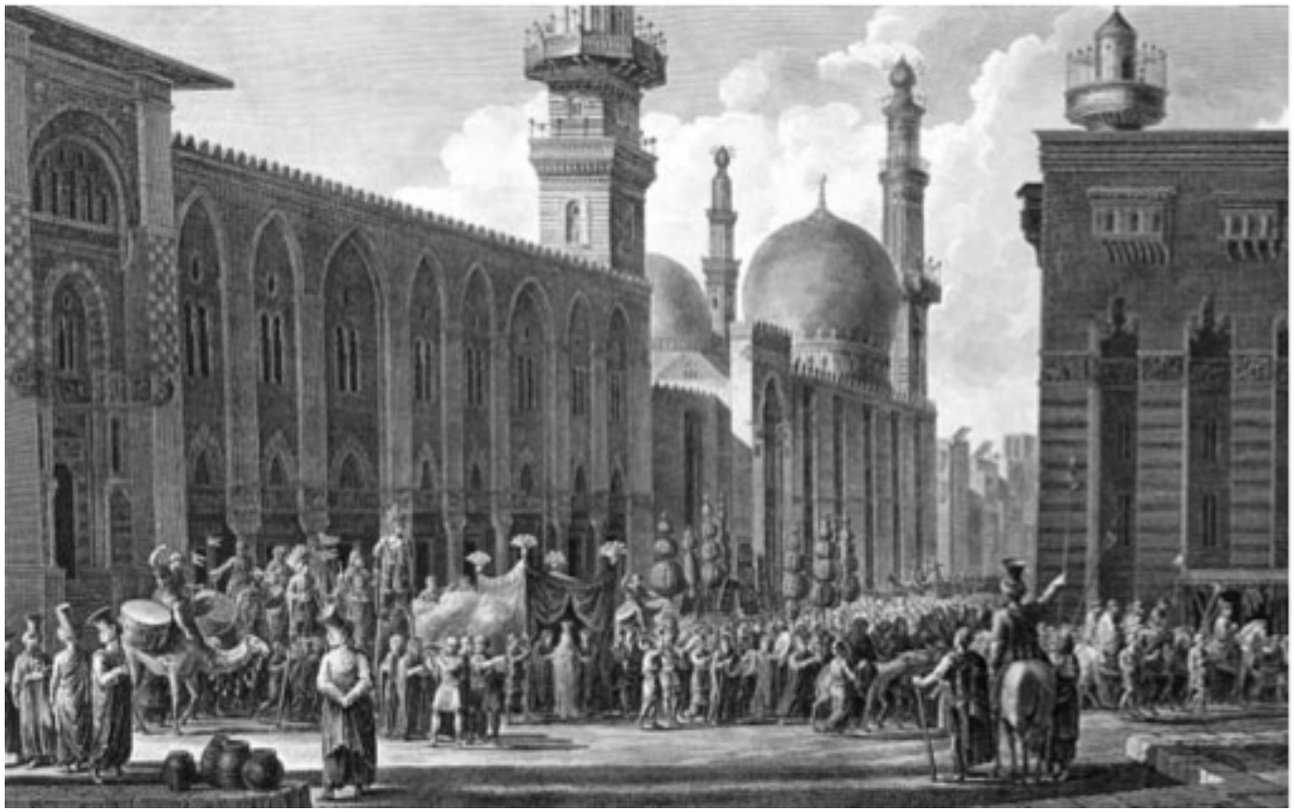


It is hardly surprising that these details from Cassas' splendid print show so many wind-catchers. This is one of the earliest images we possess of late medieval Cairo, from a time when the number of wind-catchers was diminishing year by year. Here, most of the devices shown are closed on the western side, contrary to medieval prescriptions, but have very long, overhanging roofs, which perhaps stem from the artist's imagination.

The overhanging roofs on these devices would afford additional shade for those below. However, in the case of the group of men on the roof of the house in front of the large wind-catcher above, they are praying in the open sunlight, doubtless the prayer at mid-afternoon called the *ʿaṣr*. They are facing the *qibla* of the astronomers (127°), not the old *qibla* toward winter sunrise known as the "*qibla* of the Companions of the Prophet" (117°), which, for reasons that we shall learn, was used to align the wind-catchers.



D2a



Another work by Cassas is his 1796 engraving *Wedding procession along the Bayn al-Qaṣrayn*, that is, the main axis of the medieval city. Looking beyond the main scene behind the man on horseback we can see two *bādahanj*es. They should be open not overlooking the street but rather parallel to it, away from the viewer, which would admittedly be less interesting from a visual perspective.

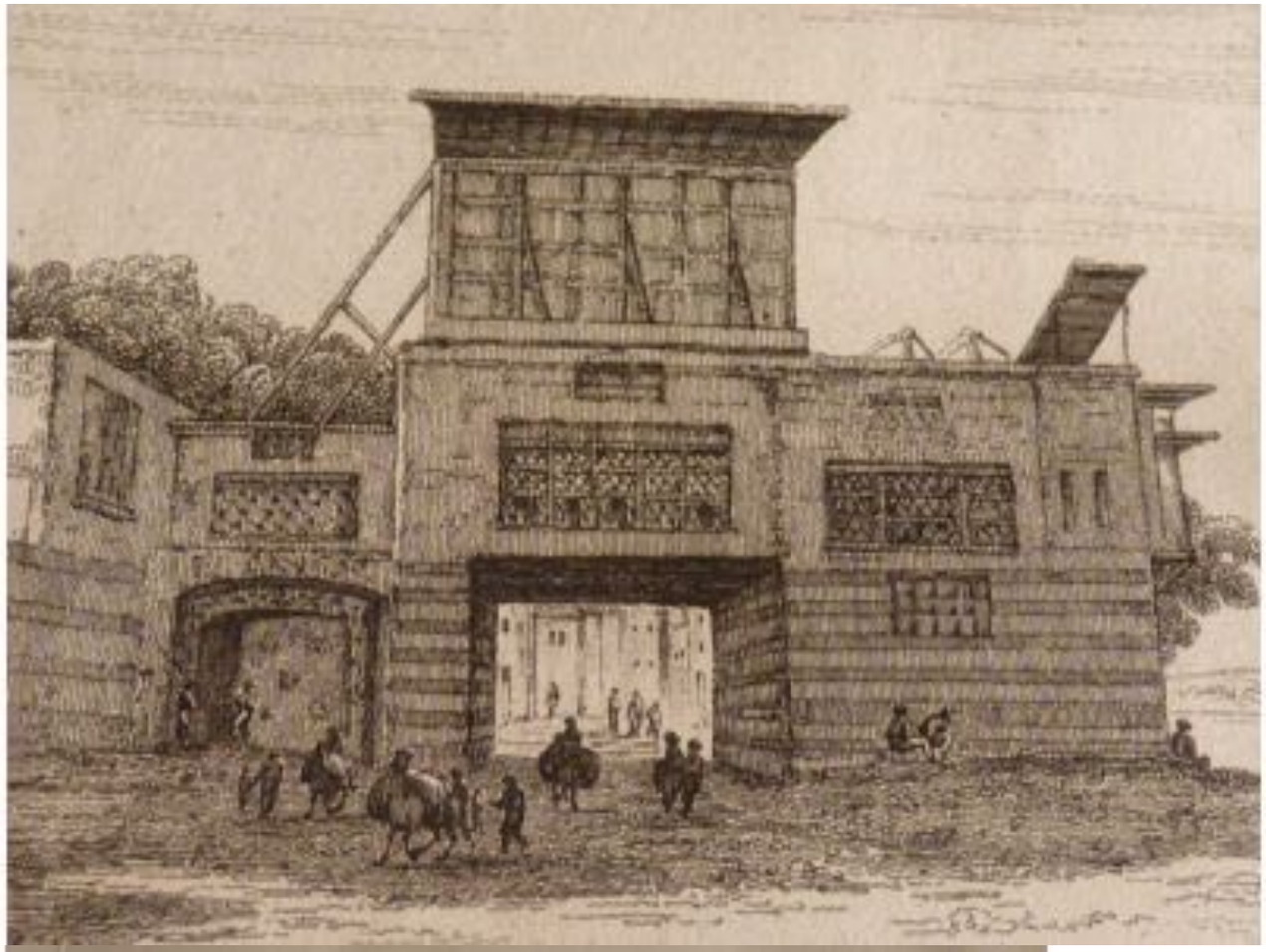
Nicholas Warner, *Monuments of historic Cairo* (2004), p. 30, fig. 24.

D3

The French artist, writer, diplomat, author and archaeologist Dominique Vivant Denon (1747-1825), captured this view of Cairo taken from the east side of the lake of Ezbekiyya during the Nile flood of 1802, with silhouettes of wind-catchers all around.

Vivant Denon, *Voyage dans la Basse et la Haute Égypte pendant les campagnes du Général Bonaparte*, Cairo, 2016, edn., also in Warner, *Cairo architecture*, p. 32..

D4



Another sketch by Vivant Denon showing a substantial wind-catcher above an unidentified city gate next to the River Nile. To the far right there is another simple one and between the two there are two small structures whose purpose is unclear.

D5

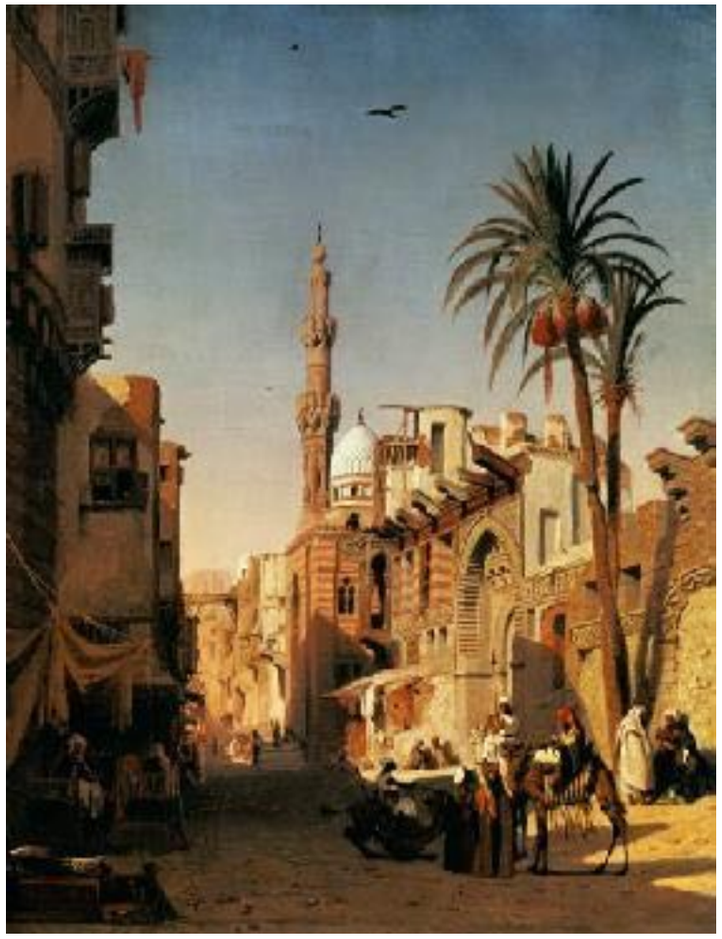
Source gallica.bnf.fr / Bibliothèque nationale de France

A drawing of the Sultan Ḥasan Mosque by the French chemist and artist Nicolas-Jacques Conté (1755-1805). This remarkable image was probably achieved with pencils of which Conté was the inventor, thanks to a British embargo on graphite. Several wind-catchers can be seen on the domestic architecture. They are not all shown facing the same direction but they should have been!

gallica.bnf.fr - [Le_Caire]___[vue_de_[…]Conté_Nicolas-Jacques_btv1b53096724b

D5a

Prosper Marilhat (1811-1847) was fascinated by trees. He painted these two magnificent sycamore fig trees in the square of Ezbekiyya with three parts of the city visible in the background. Several wind-catchers are shown in the detail on the right, a single one in the detail at centre.

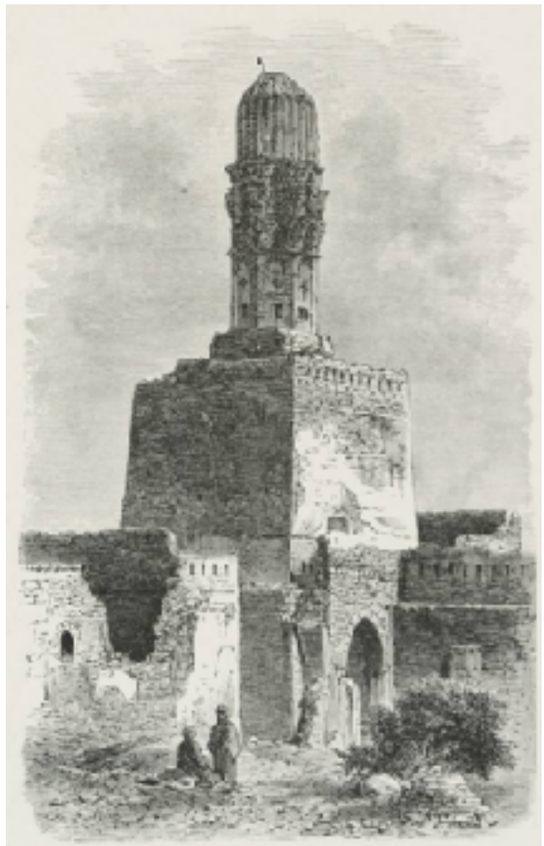


Marilhat showed a solitary palm tree on his view of a Cairo street. A curious agglomeration of accessory constructions is shown on a roof-top.

www.mutualart.com/Artwork/Vue-de-la-Place-de-L-Esbekieh-et-du-Quar/06FA4300F44F9590
(all available images are blurred).

www.wikiwand.com/en/Prosper_Marilhat

D5b



Marilhat's painting of the ruins of the 10th-century Mosque of al-Ḥākim. Even Marilhat refrained from including a tree in this scene of desolation. On the right an anonymous woodcut of another view dated 1878.

https://commons.wikimedia.org/wiki/File:Marilhat_Prosper_Georges_Antoine_Ruines_De_La_Mosquee_Du_Calife_Hakem_Au_Caire.jpg

https://en.wikipedia.org/wiki/Al-Hakim_Mosque#/media/File:Mosque_of_El-Hakim_(1878)_-_TIMEA.jpg

D6

View over part of Cairo after the fire of 1838, taken from a Christian convent in the European quarter of El-Mouski. This is prepared from a wood engraving after Joseph-Philibert Girault de Prangey (1804-1892). Various wind-catchers are still standing after the fire, one taller than average and another three times the standard width. Note that they are facing two principal directions, the one perpendicular to the other; this is, of course, absurd. But the wood-cut was supposedly made from a daguerreotype!

Girault de Prangey, *Panorama d'Égypte et de Nubie,* 1841, from Stephen C. Pinson, ed., *Monumental journey – The Daguerreotypes of Girault de Prangey*, 2019, p. 18.

D7

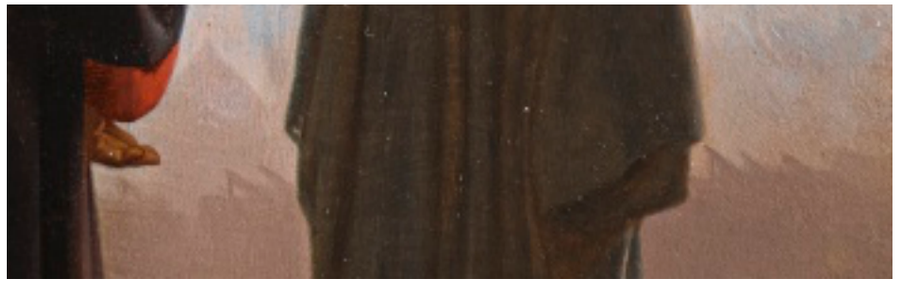
Gérôme's magnificent painting "Prayer on the rooftops" shows men at prayer and two wind-catchers amongst the minarets. The men are praying in the same direction as the openings of the wind-catchers, that is, roughly 30° E of N, so this painting was not achieved *in situ*. Gérôme's paintings of Cairo were mostly prepared in Paris from his sketches. Note the wind-catchers are incorrectly shown open on each side.

King, *In Synchrony with the Heavens*, vol. 1, cover. See esp. pp. 860-862 on the complex composition of this painting. Original in the Kunsthalle, Hamburg.

D7a

Another version of the same scene by Gérôme himself was auctioned at Sotheby's of London in April, 2019.

It shows yet more wind-catchers than the Hamburg painting, including some in the distance which are not visible on the other. Gérôme knew they were to be found on nearly all buildings.



www.sothebys.com/en/auctions/ecatalogue/2019/the-orientalist-sale-l19100/lot.22.html

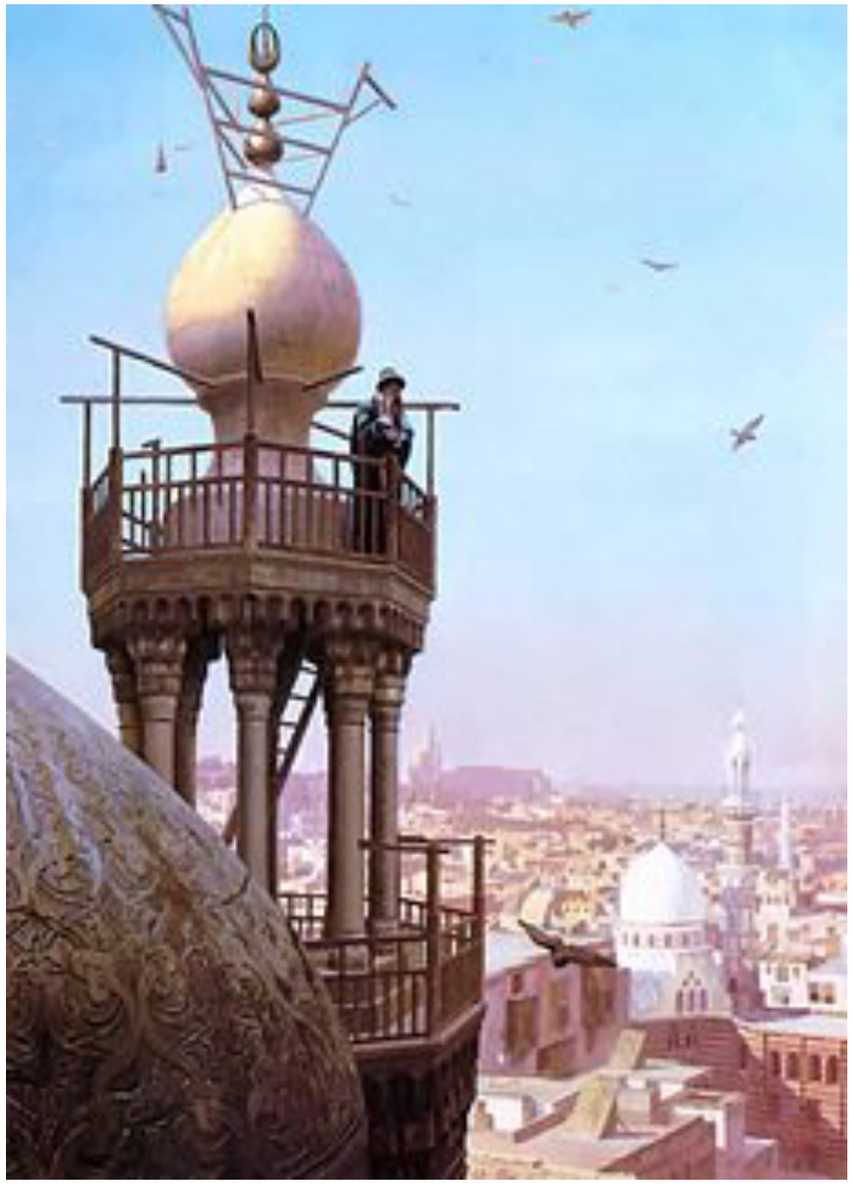
D8

Gérôme's view over Cairo shows a dozen wind-catchers, mainly between the two minarets on the left.

D9

Gérôme's view of Cairo at a distance also reveals a few wind-catchers to a discerning eye.

D10



In Gérôme's splendid painting "Call to Prayer" one can see several wind-catchers on the roofs dominated by the mosque.

D11

Missing from this extract of a painting by Gérôme of the view over Cairo from the Citadel is Napoleon on his horse appreciating the view. Present are a number of wind-catchers on private houses, far more than one would think at first glance.

Humbert *et al.*, *Boneparte et l'Égypte*, pp. 318-319.

D12

Certainly Gérôme knew about the wind-catchers of Cairo! His famous painting of Napoleon on horseback overlooking the city shows dozens of wind-catchers, particularly these just below the conqueror. Note the women hanging out the laundry and the long-legged cats looking for pigeons on the *bādahanj*es. A reminder: this picture was painted close to 200 years ago.

Humbert *et al.*, *Boneparte et l'Égypte*, pp. 318-319.

D12a

www.travelandleisure.com/slideshows/how-to-have-a-hurricane-proof-vacation?slide=111519#111519

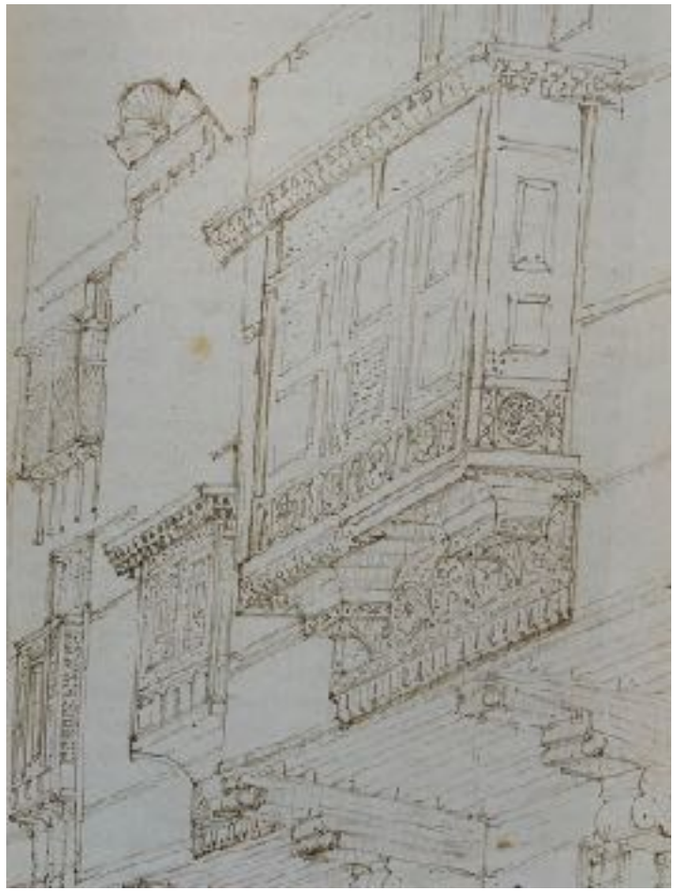
A detail from an oil sketch by Gérôme of the same scene, in which the wind-catchers are faithfully included but their purpose is no longer discernible. Also, the residents have disappeared from the rather bleak-looking roofscape in front of the mosque and its minaret.

Ackermann, *Gérôme* (1986), p. 223 (no. 173B).

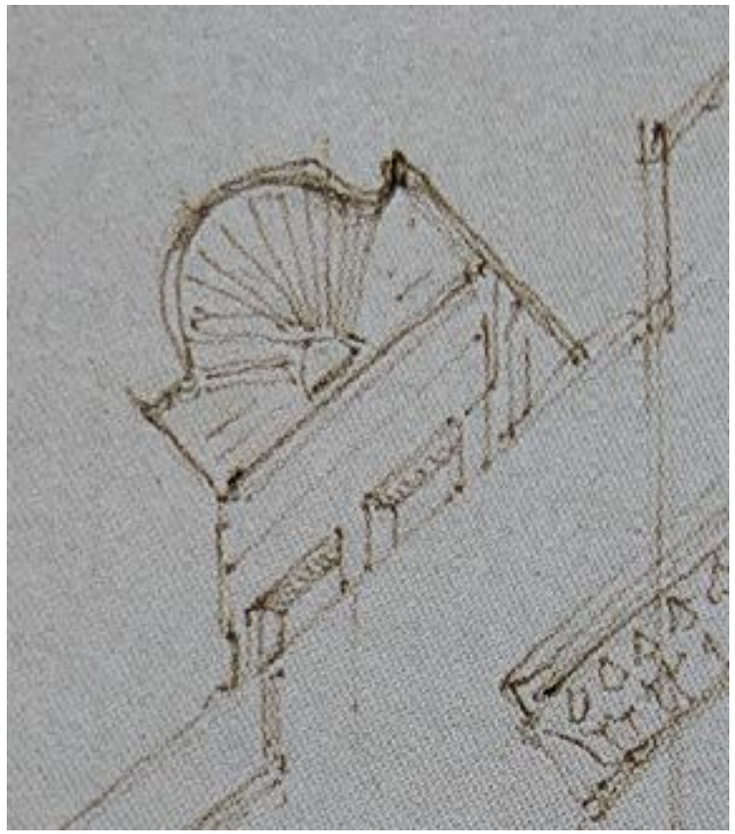
D13

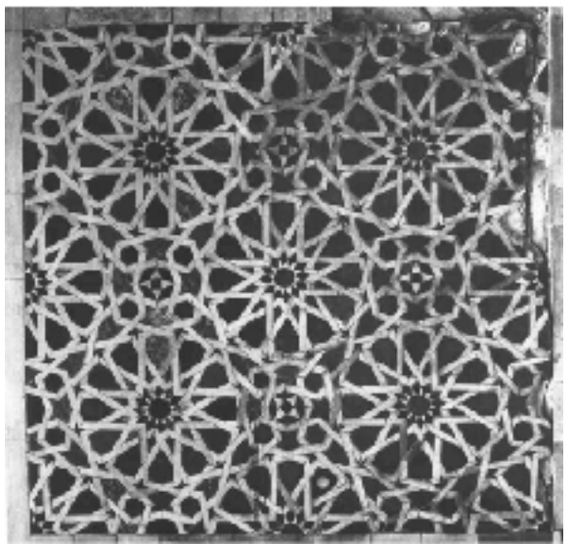
Two images by Eugène Poitou (1815-1880), advisor to the Court of Anger, who spent the winter of 1857 in Egypt and authored an illustrated book *Un hiver en Égypte*. He has left us two views, one of the square of Ezbekiyya and the other of a city gate. The wind-catchers in the right foreground have both sides open and the one near the gate has both sides closed.

D14



M. Bideault, “Le Cire dans l’œuvre graphique de Jules Bourgoin”, p. 107.





An architectural drawing of a house façade with a *mashrabiyya* by Jules Bourgoin (1838-1908). On the roof there is a decorated wind-catcher. Bourgoin was the first scholar to document Islamic geometric design, of which the splendid example on the left is from the palace of Riḍwān Beg (Pl. F13). Maryse Bideault, who has published extensively on Bourgoin, rightly complains that his achievements are not widely appreciated, but at least his major work has been reprinted by Dover (*Arabic Geometric Pattern and Design*, 1973).

Photographed by architecture historian Jacques Revault, from Bideault, *L’iconographie du Caire dans les collections patrimoniales françaises* (2010), original in Aix-en-Provence, MMSH, Iconothèque.

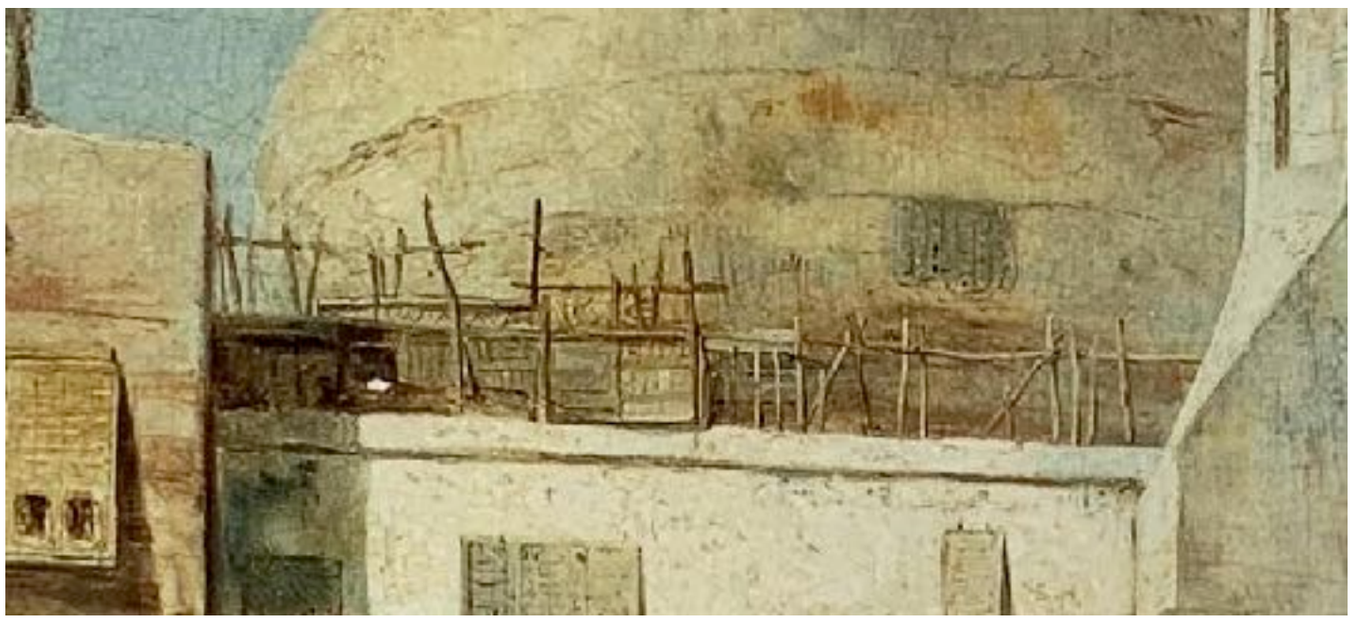
D15

A watercolour of the inner courtyard of the al-Azhar Mosque attributed to Joseph-Philibert Girault de Prangey (1804-1892). To the left one can see the front of several wind-catchers, all facing roughly NNE. The *qibla* of the Mosque is perpendicular to this (give or take 10°) at ESE off to the left. Another large wind-catcher is partly visible to the left of the minaret above the main entrance.

www.wdl.org/en/item/14760/view/1/21/

D16

The main entrance to the al-Azhar Mosque as painted by Adrien Dauzats in 1831. Not only can one see a single wind-catcher in a state of collapse but there are several wooden frames for defunct wind-scoops visible on the nearby balcony.



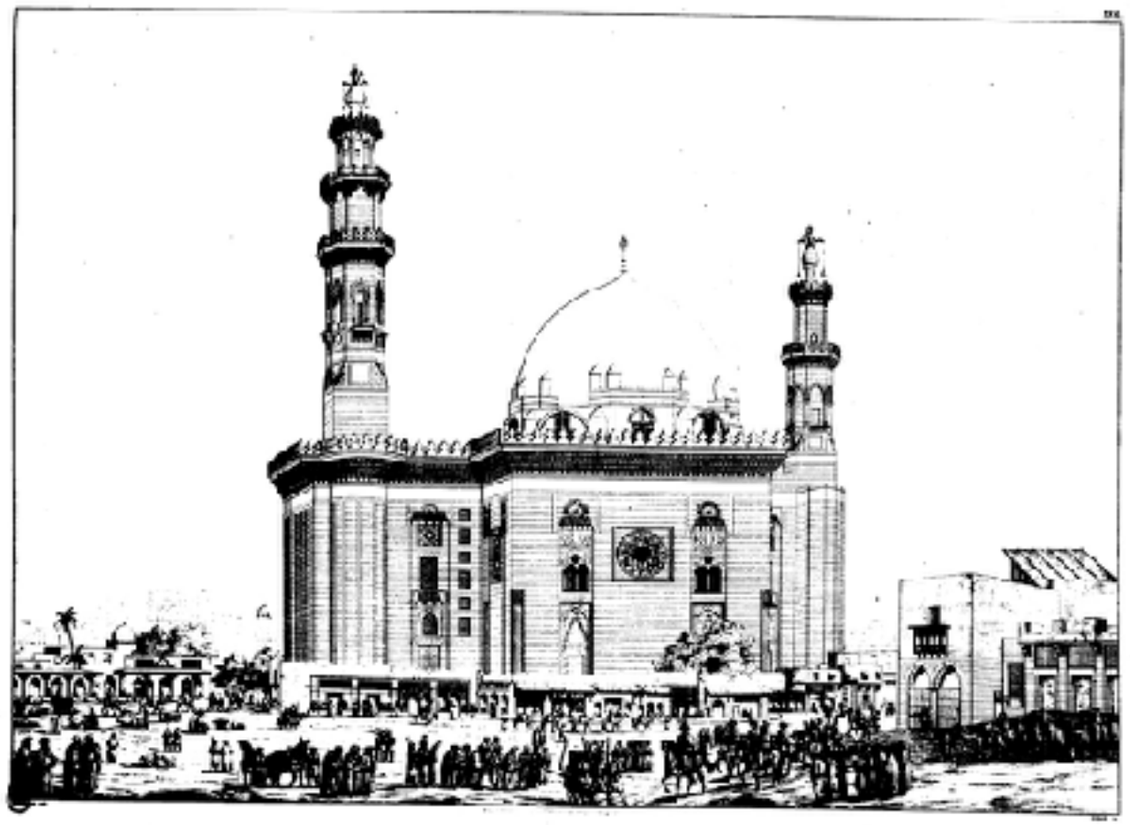
Humbert *et al*., *Boneparte et l'Égypte*, pp. 310-311.

D17

An aquarelle by Nicholas-Jacques Conté (1755-1805): A farmer with his plough drawn by two cows. In the village behind them a solitary wind-catcher is visible.

Humbert *et al*., *Boneparte et l'Égypte*, p. 90.

D18



A print of the Sultan Ḥasan Mosque from *ca.* 1820 by Pascal Coste (1787–1879) with the back of a wind-catcher shown on a nearby house. It looks as though the left-hand side is open, as it should be.

Pascal Coste, *Architecture arabe ou Monuments du Kaire* (1839), pl. 26.

D19

A perhaps rather idealised painting of part of the lake known as Birkat al-Fīl by a certain M(onsieur) Freeman, published by Adalbert de Beaumont (1809-1869). The scene shows a paradise for flamingoes but also for wind-catchers of varying sophistication. The lake was filled in not long thereafter.

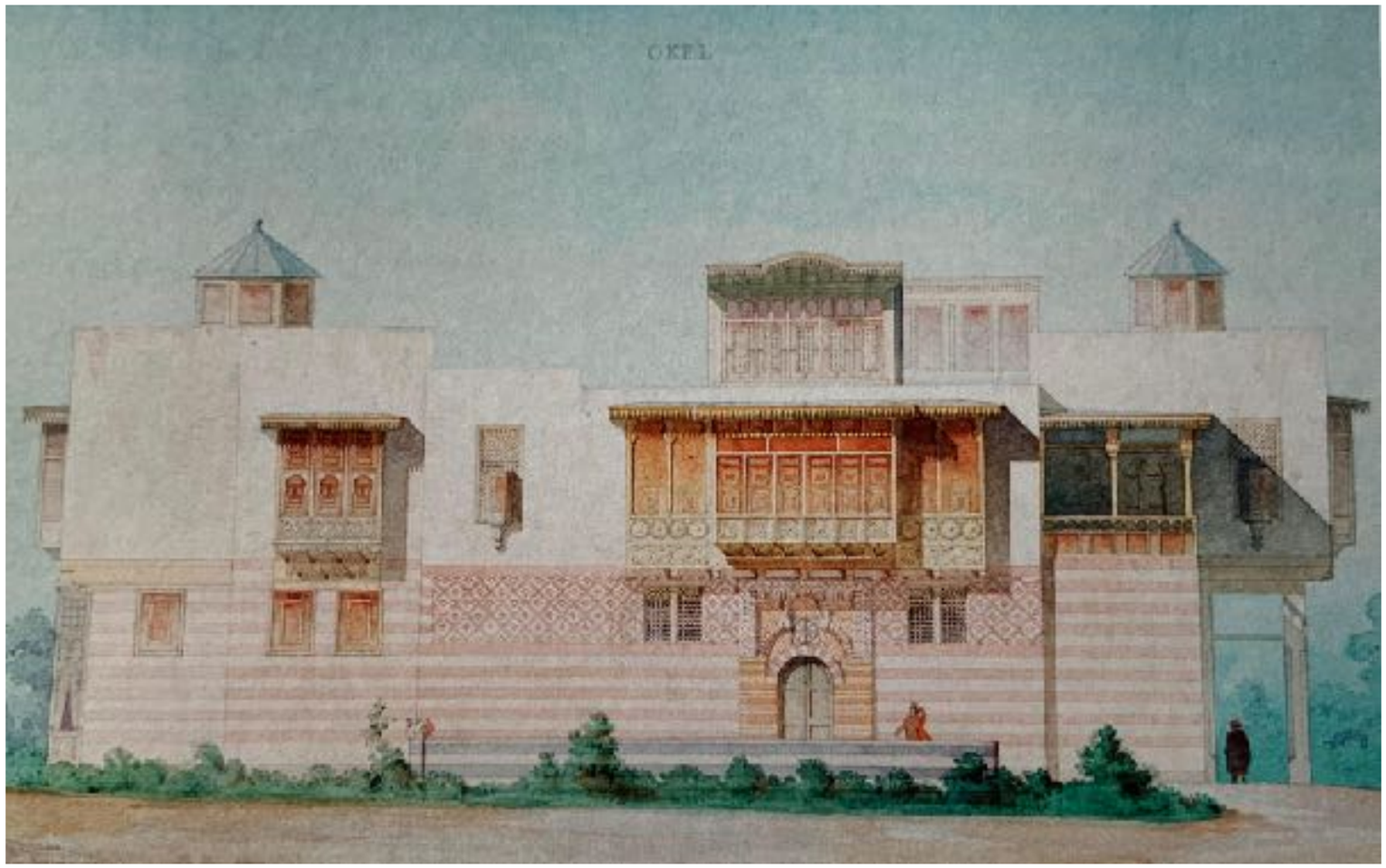
Chantal Bouchon, "Le Caire d'Adalbert de Beaumont" (2013), p. 257.

D20

An engraving of a *wikāla* or rest-house showing the *bādahanj* as an integral part of the building. A reconstruction of this building was prepared for the Egyptian pavilion of the Paris Exposition universelle in 1867.

Alia Nour, "Egyptian-French cultural encounters at the Paris Exposition universelle of 1867" (2017), p. 36, fig. 5, from Charles Edmond, *L'Égypte à l'exposition universelle de 1867* (1867), p. 202.

D21



The façade of the *wikāla* (*okel*) or resthouse at the 1867 Paris exhibition was featured again in the 2009 catalogue of an exhibition on Napoleon and Egypt at the Institut du Monde Arabe in Paris, where not even the splendid *mashrabiyya*s were considered worth mentioning, let alone the two substantial wind-catchers.

Humbert *et al*., *Boneparte et l'Égypte* (2008), p. 379.

D22

Louis Amable Crapelet (1822-1867) was a French water-colour painter. He spent 1852-54 in Egypt and painted these delicious scenes. Above, the view is of the port of Būlāq. A simple but serious *bādahanj* is shown open towards the Nile, whereas it should be open towards the north. At right: another Nile-side scene and an extra-ordinary view of the Mosque of Sultan Barqūq.

www.museeregardsdeprovence.com/exposition/merveilles-de-lorientalisme
https://sarahbguestperry.blog/category/watercolor/.

E: Danish, German, Belgian* and Swiss** artists

“A *bādahanj* in which the air of east and west
Flows according to the best manner and method –
When the winds of the atmosphere come to it in disarray,
They blow in it in no other way but an orderly one.”
The poet Burhān al-Dīn al-Qīrāṭī, writing in Cairo *ca*. 1350.

*** The Belgian Huysmans was located at the last minute by googling “deutsche orientalisten maler kairo”! ** Was Rappoport Swiss?**

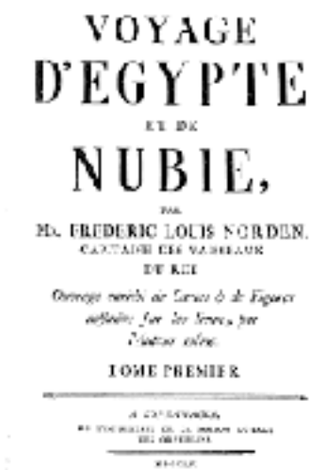
E1

A view of Dayr al-Tīn, near Old Cairo, by the Danish naval captain and explorer Frederic Louis Norden (1708-1742) in during his journey up the Nile to the Sudan in 1737-38. Note the two wind-catchers, one on the right fairly intact and one on the left a bit rickety.

F. L. Norden, *Voyage d'Égypte et de Nubie* (*Journey to Egypt and Nubia*), Paris, 1795, vol. I, Pl. XXXVII, also at www.gettyimages.co.uk/detail/news-photo/view-of-deir-etiin-near-old-cairo-egypt-engraving-from-news-photo/1150985331, photo by Icas94 / De Agostini via Getty Images.

E2

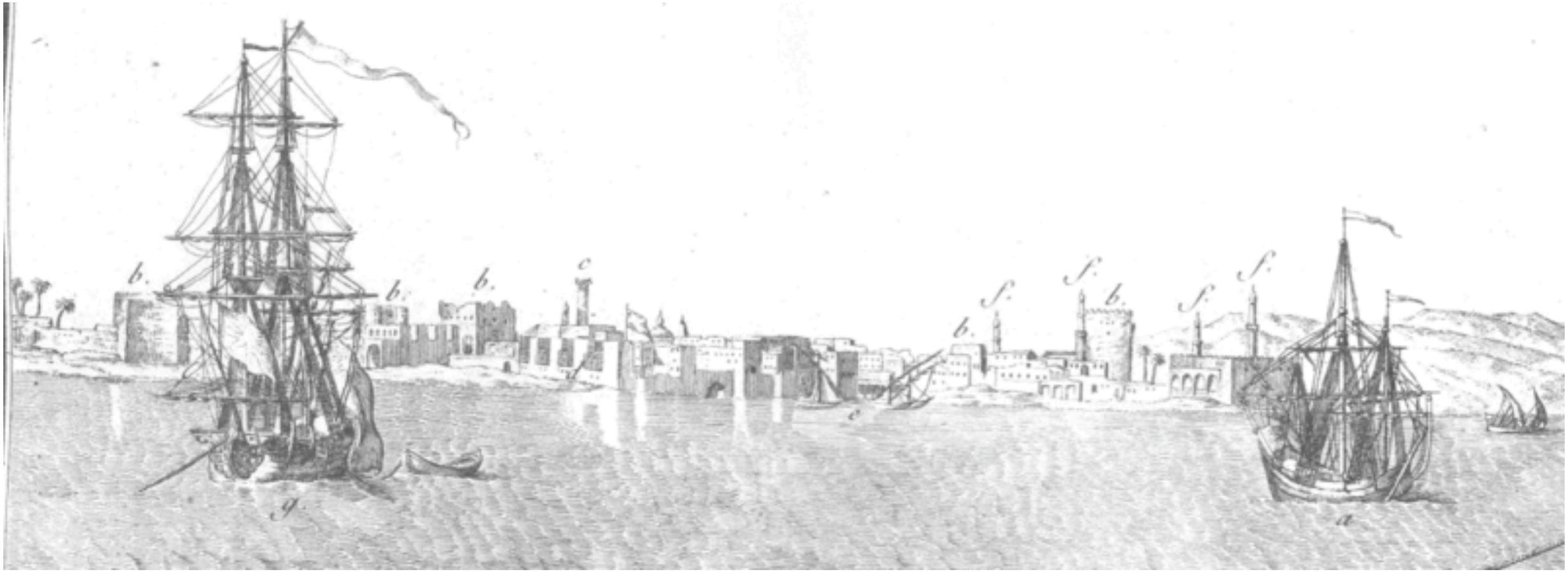
A view of the coast at Alexandria by Norden published in 1795. Some of the medieval astronomical texts propose orienting wind-catchers in locations other than Cairo, but when I first saw this picture, it took me by surprise. The background looks rather like Ezbekiyya Lake in Cairo as recorded in the *Description de l'Égypte*, but these are not wind-catchers – see Pl. E3.


VOYAGE
D'EGYPTE
ET DE
NUBIE,
PAR
M. FREDERIC LOUIS NORDEN,
CAPITAINE DES VAISSEAUX
DU ROI
TOME PREMIER

"Perspective du Vieux Caire" by Norden, dated 1755. Just one wind-catcher is shown in a city that at the time was full of them.

https://commons.wikimedia.org/wiki/File:Alexandrie_Voyage_d%27Egypte_et_de_Nubie_5_par_Norden_1795_detail.png

E3



Deceived by the letters of the alphabet, which are ciphered by Norden in an accompanying key … …

E4

“Mein Fritz geht nach Ägypten!”

This aquarelle is by the German painter Friedrich Maximilian Hessemer (1800-60), who visited Cairo in 1829-30. It features the minaret and dome of the Mosque of Abu ‘l-ʿIlā in Bulaq. The back of a substantial wind-catcher is visible to the right of the dome. The left-hand (western) side is open, as it should be according to medieval prescriptions.

From M. Bideault, ““Mein Fritz geht nach Ägypten””, p. 27.
(Not featured in Eichener & Greve, eds., *Hessemer in Ägypten* (2001)!)

E5

This remarkable painting by Bernhard Fiedler (1816-1904) of the view from the Citadel toward the Mosque of Sultan Ḥasan shows the numerous wind-catchers which preceded those shown in early photographs. The work was completed in 1853-54 and a black-and-white version was published by the German Egyptologist Georg Ebers in 1878-80 in his *Aegypten in Bild und Wort.*

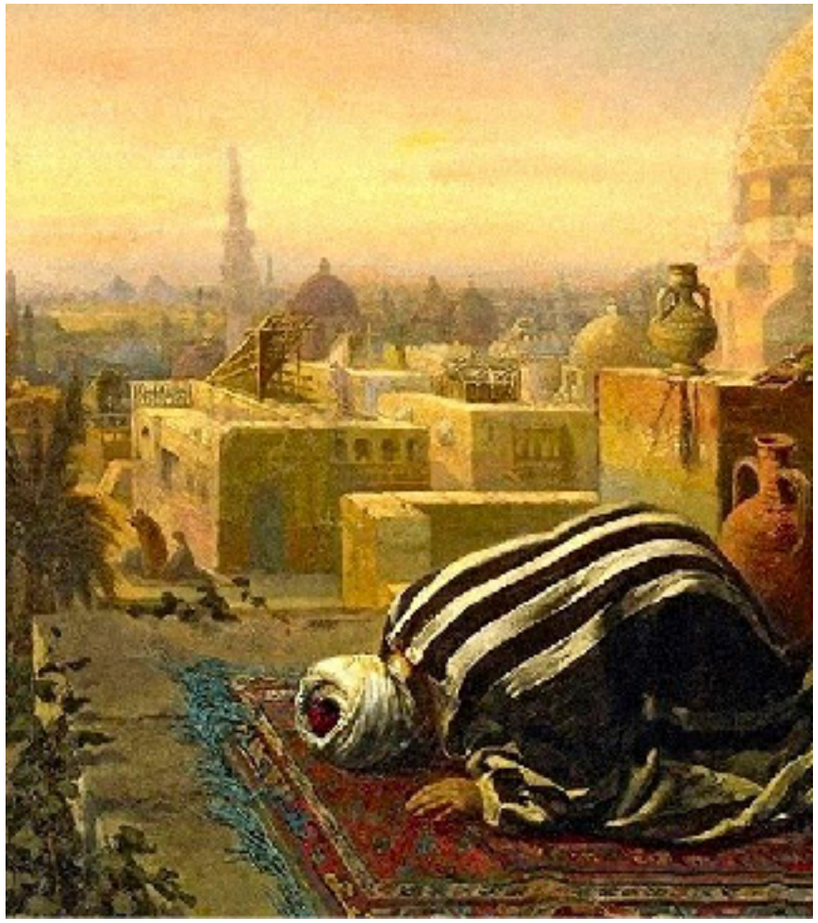
Kunsthistorisches Museum, Vienna, *via* https://commons.wikimedia.org/wiki/File:Bernhard_Fiedler_-_Ansicht_von_Kairo_-_2986_-_Kunsthistorisches_Museum.jpg; also Ebers, *Aegypten in Bild und Wort.*

E6

Another painting by Bernhard Fiedler currently for purchase at Kunsthaus Lempertz. The title in the sales catalogue could well be changed from
“A street in Cairo with a minaret”
to
“A street in Cairo with a minaret & the back and side of a wind-catcher”.

www.lempertz.com/en/catalogues/lot/934-1/63-bernhard-fiedler.html.

E7

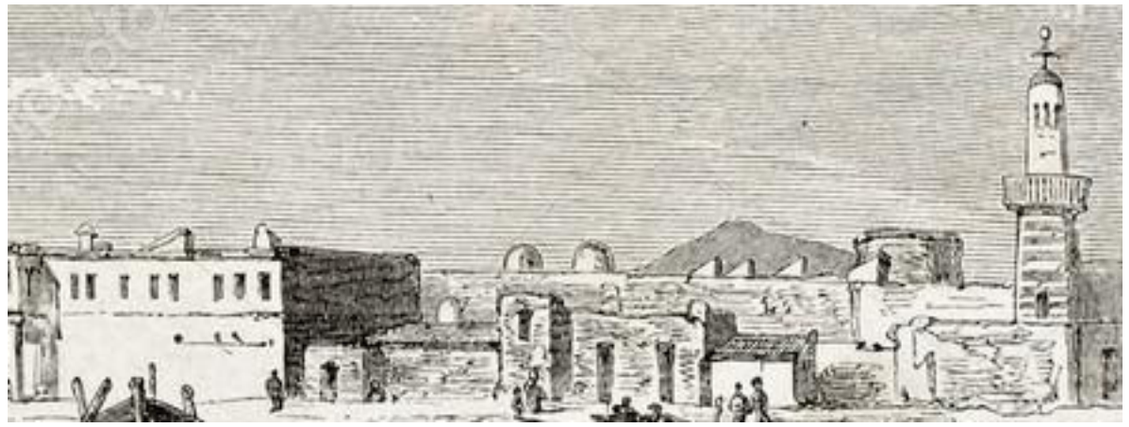


The Flemish painter Jan-Baptist Huysmans (1826-1906) produced a remarkable set of paintings during his extensive travels in the Muslim lands bordering the Mediterranean. His painting "Evening prayer" (1859), clearly inspired by the painting of Gérôme (Pl. D7), shows in great detail two wind-catchers on neighbouring houses, and two more if one looks carefully.

https://i.pinimg.com/originals/21/96/52/219652b6d32bd21970910701f2dabe5e.jpg.

E8

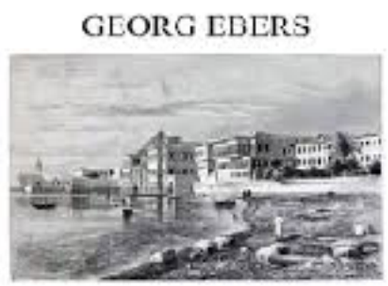
www.agefotostock.com/age/en/Stock-Images/Rights-Managed/HEZ-1277172



Wind-catchers on houses in the Red Sea port town of Qusair. Sketch from Lejean, *Tour du monde*, 1868.

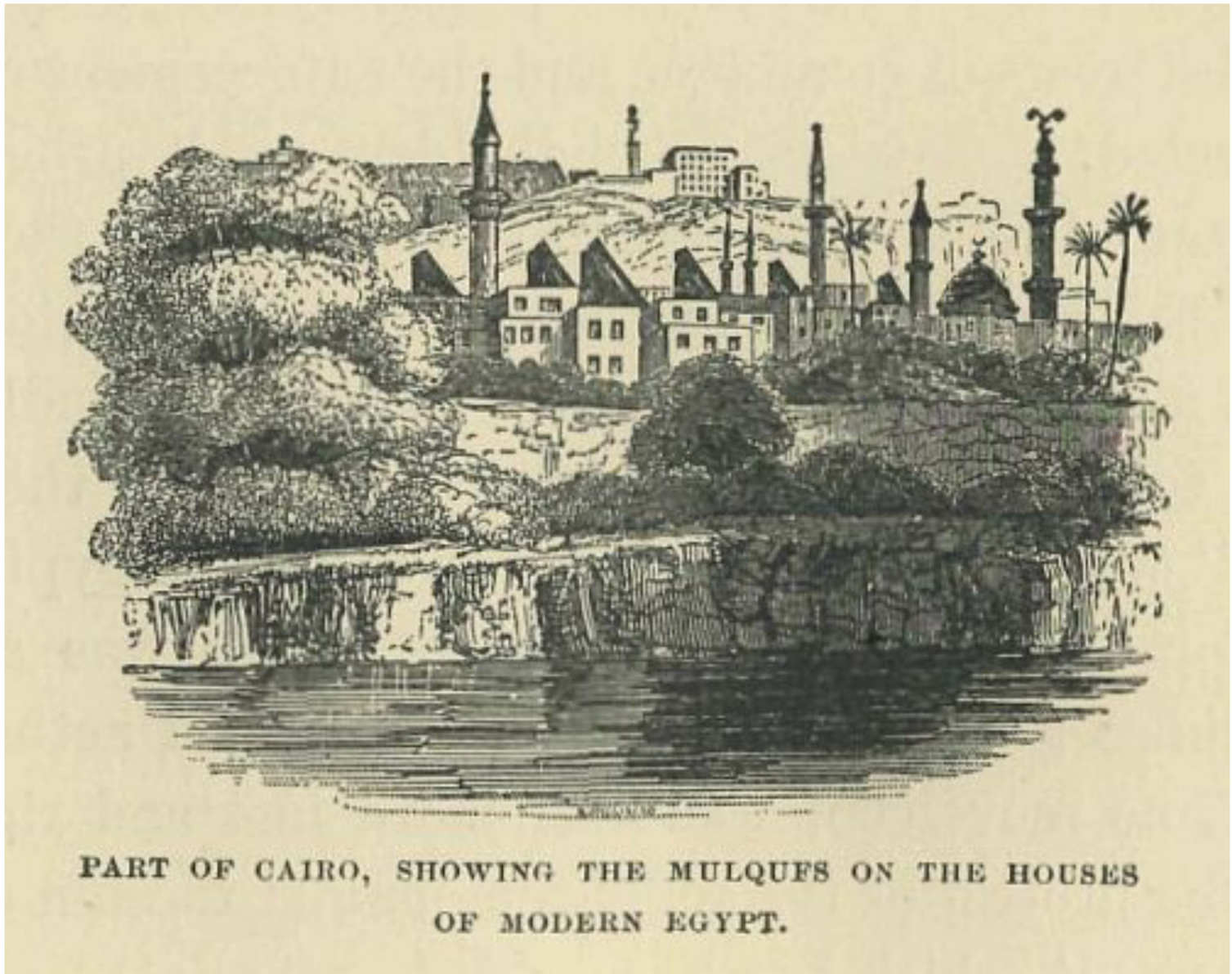
https://depositphotos.com/13330088/stock-photo-al-qusair.html.

Two images from Georg Eber's illustrated book on Egypt, first published in 1879-80. Above is a scene from the market at the town of al-Dasouq in the in the Nile Delta, with what seems to be a wind-catcher to the right of centre. To the lower right is a view of the Ezbekiyya Lake in Cairo (? looks more like the sea coast) with rather modern-looking buildings and two wind-catchers on the extreme right.



Georg Ebers, *Egypt – Historical, descriptive and picturesque* (11878-80), E-book, n.d., front cover, at www.amazon.com/Egypt-Descriptive-Picturesque-Georg-Ebers-ebook/dp/B076FFLHJV.

E9



PART OF CAIRO, SHOWING THE MULQUFS ON THE HOUSES OF MODERN EGYPT.

The title of this charming illustration in S. Rappoport's 1905 *History of Egypt* speaks for itself. The view is supposedly from the Nile looking east towards the Citadel. Otherwise, this does not look like a view of Cairo as seen from the Nile and the Citadel looks more like the Alhambra Hotel in Granada. But there are '*mulquf*s' galore, which had been a feature of the city for over 900 years.

S. Rappoport, *History of Egypt*, vol. 12 (1905), fig. 190, at www.gutenberg.org/files/17332/17332-h/17332-h.htm#linkBimage-0014.

E10

This charming scene in a small town with an imposing mosque was painted by the Swiss artist Otto Pilny (1866-1936). Most of his paintings depict encounters in the desert, but this one is probably intended to show a scene on the outskirts of Cairo. In the distance on the far left we can see a substantial wind-catcher on a tall building as well as, through the haze, some kind of cylindrical tower.

www.sothebys.com/en/auctions/ecatalogue/2018/the-orientalist-sale-l18100/lot.51.html

F: English and Scottish artists

“If ... local methods do not provide all that is needed in an age of change and activity, they are at any rate, though perhaps curiously, adapted to the physical conditions of the country; and an architect will lose nothing by studying them respectfully.” Ernest Tatham Richmond (1874-1955), sometime Director of Public Buildings for Egypt, addressing in 1911 the Royal Institute of British Architects on the subject of indigenous Egyptian building techniques.

F1

A somewhat fanciful view over Cairo painted by Henry Salt (1780-1827), British Consul in Egypt from 1816 until his death.
Not a single wind-catcher is shown.

www.wikiwand.com/en/Timeline_of_Cairo.

F2

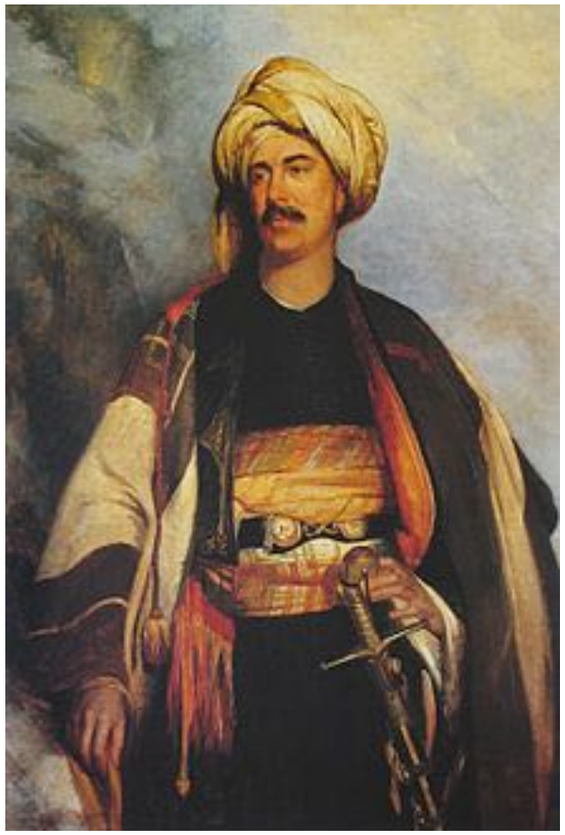
The Scotsman David Roberts (1796-1864) during his visit to Egypt and Palestine in 1838-39 prepared two splendid sketches relevant to our subject. In this view over the city usually labelled “looking west” or “from the east” we see to the left of the dome at the centre two large wind-catchers, one in better shape than the other. Behind these are several more.

F3

Detail of Roberts' lithograph showing wind-catchers galore, some not in the best of shape.

F4

In this lithograph by David Roberts of the Sayyida Zaynab gate and neighbouring religious complex, a substantial wind-catcher is visible in front of the dome at the centre of the painting, with a smaller one to the right of it.



David Roberts in the clothes he wore in Palestine in 1840, painted by Robert Scott Lauder.

https://en.wikipedia.org/wiki/David_Roberts_(painter)

F5

Detail of the second Roberts' painting.

F6

In this image from *ca*. 1840 of the Palace of Sharīf Bey on the right beyond the Square of Ezbekiyya by the Scotsman Robert Hay (1799-1863), several rather primitive wind-catchers are illustrated, all with both sides open.

F7

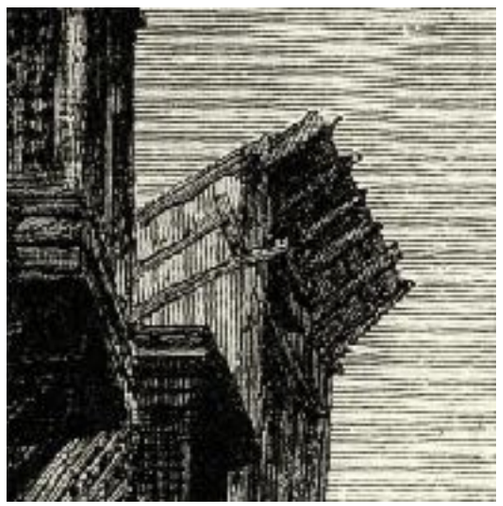
Above a building behind the Cairo slave market near the al-Azhar Mosque, Robert Hay (*ca*. 1830) has depicted a curious wooden construction on a distant building. Perhaps this was a wind-catcher? Equally mysterious are the (presumably) ancient columns also shown.

Botte, "Des européens au marché aux esclaves" (2016), fig. 1, from http://wellcomeimages.org (where it is listed as "Lithograph by J.C. Bourne after O.B. Carter and H. Warren, ca. 1860.").

F8

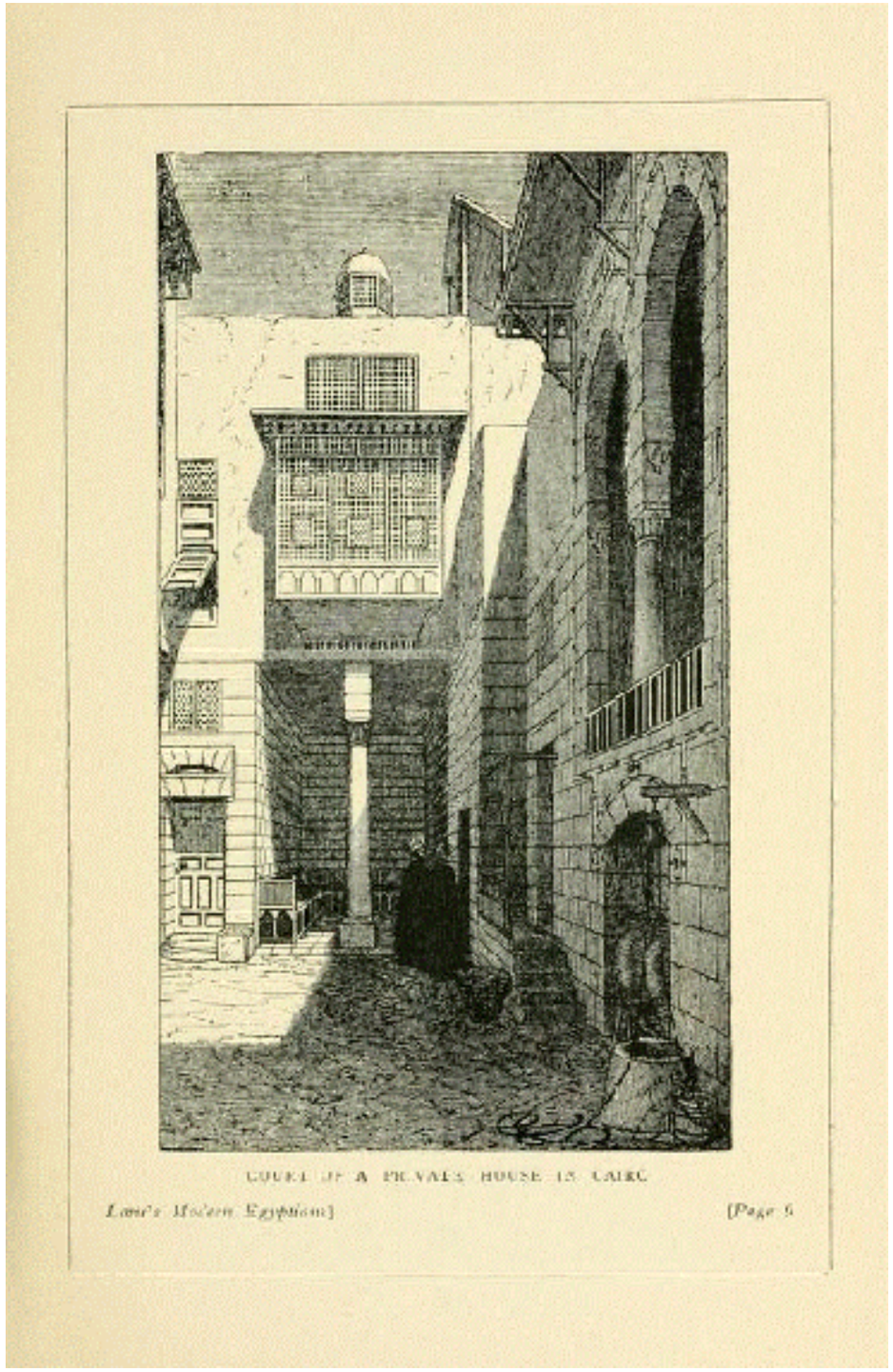
The Scotsman Robert Duncan presented an image of a street in the Coptic quarter of Cairo with a single *bādahanj* on one of the roofs and the opening overlooking the street.

The implication is that the street is perpendicular to the main axis of the city.

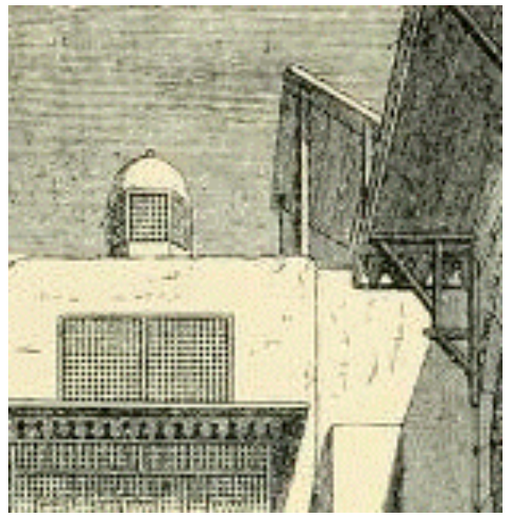


Available at gettyimages-842845112-2048x2048.jpg

F9

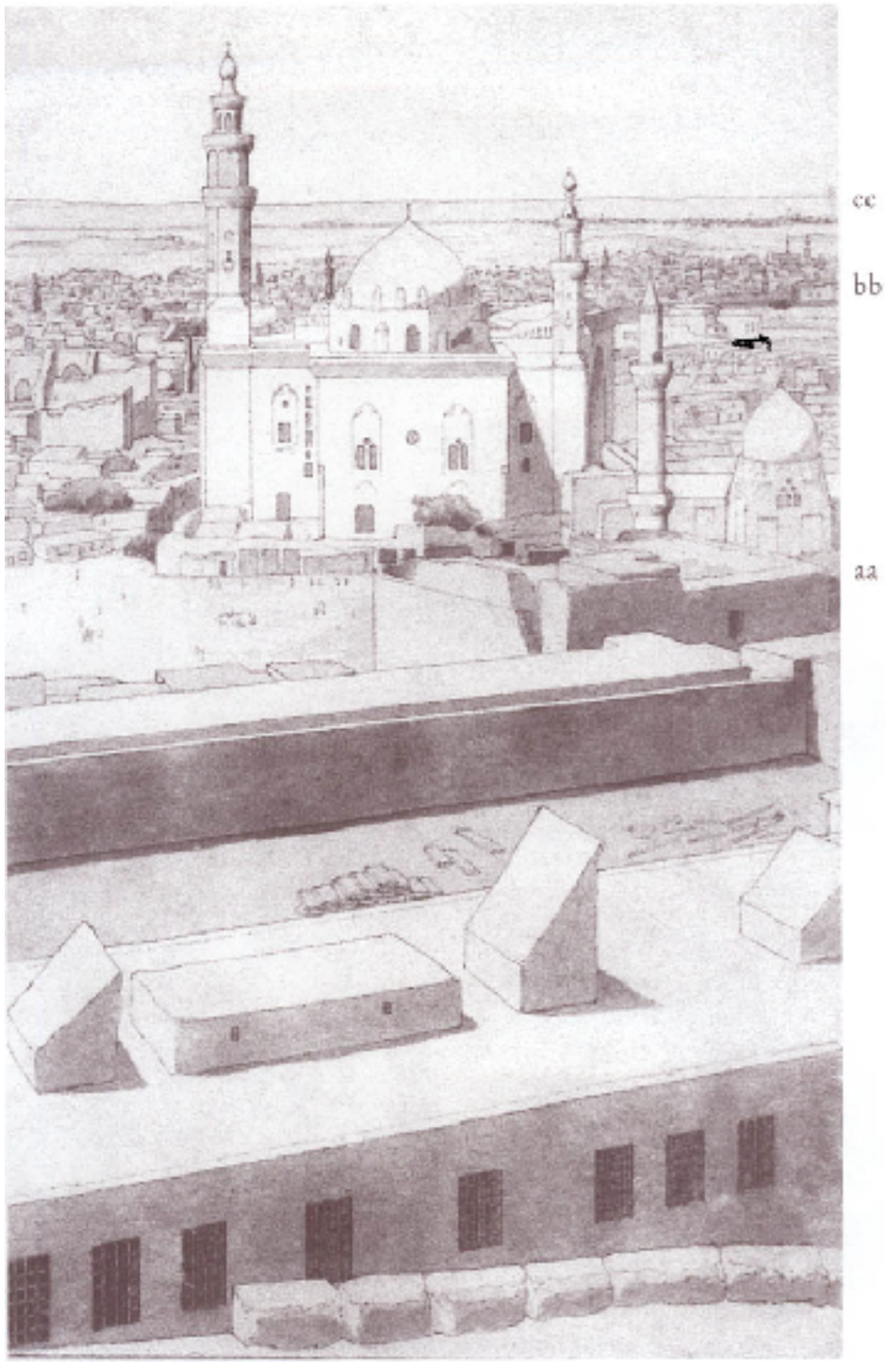


Edward W. Lane was an English orientalist who not only prepared a splendid *Arabic-English Lexicon* of Classical Arabic but also wrote a sociological study *The Manners and Customs of the Modern Egyptians* (1895).



In this he included a sketch of a private house, on the roof of which is a wind-catcher. The *mashrabiyya* below is in full sunlight, thus presumably facing a southerly direction. The wind-catcher should not be perpendicular to this, but rather, facing away from the viewer, and then, necessarily, less interesting of aspect.

F10



Lane, *Description of Egypt*, ed. Jason Thompson, 2000, pl. 21.

This and the next two images are from Edward Lane's *Description of Egypt*, datable *ca.* 1832, a substantial work recently made available for the first time.

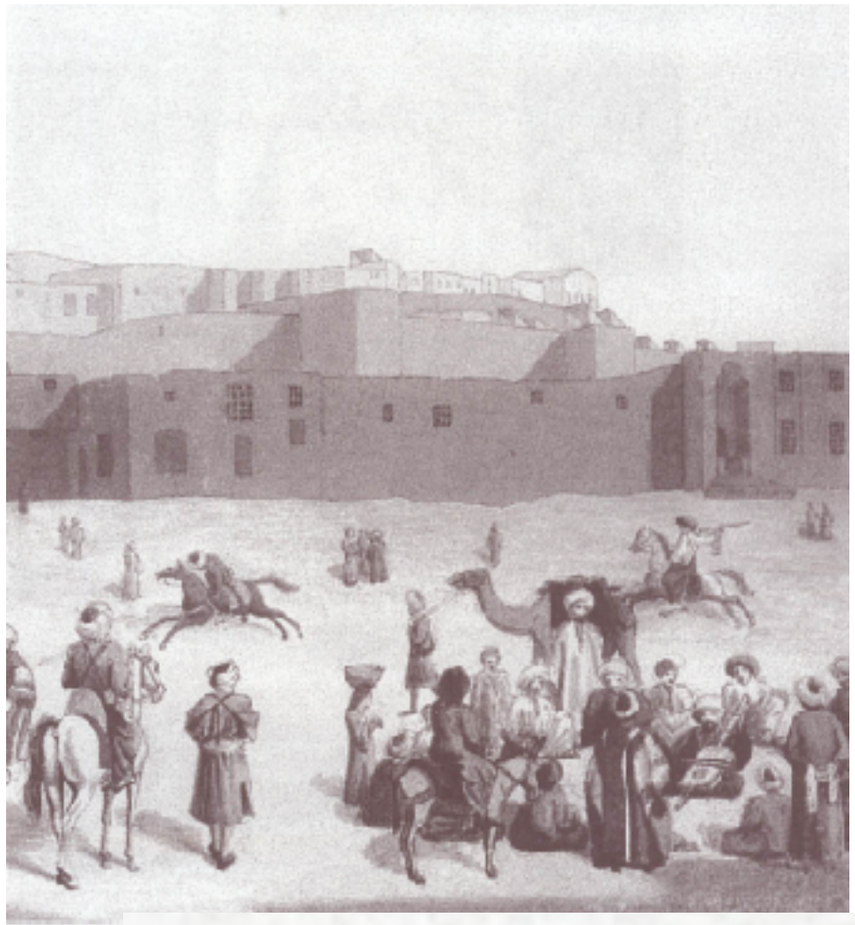
Here three rather solid-looking wind-catchers are shown on top of a building looking down towards the Mosque of Sultan Ḥasan.


AR. BIC-ENGLISH
LEXICON,

Neither the first nor the last Englishman to be captivated by Egypt.

Images from Wikipedia.

F11



Various wind-catchers are shown in a scene looking up toward the Citadel.

Lane, *Description of Egypt*, ed. Jason Thompson, 2000, pl. 20.

F12

Edward Lane's view over the city, showing wind-catchers galore.

Lane, *Description of Egypt*, ed. Thompson, 2000, from Thompson, "Edward William Lane in Egypt" (1997).

F13

The British landscape painter Frank Dillon (1823-1909) visited Cairo four times in the period 1850-70 and produced a remarkable group of paintings, mainly of domestic interiors. These two outside scenes from 1870 are of the palaces of the *mamlūk* Riḍwān Beg, dated 1650. In the first painting, on a house to the right of his palace there is a very tall *bādahanj* together with a smaller one partly hidden by a palm-tree. In the second one, the house to the left of the palace sports a rather flimsy-looking *bādahanj* open on both sides.

Images courtesy of the Victoria & Albert Museum, London. http://media.vam.ac.uk/collections/img/2008/BU/2008BU4478_2500.jpg & https://www.kunstkopie.de/a/dillon-frank/house-of-memlook-radnau-b.html.
See also www.1st-art-gallery.com/Frank-Dillon/House-Of-Memlook-Radnau-Bey-Cairo-2.html.

F14

The English artist Frederick Goodall (1822-1904), in this charming scene entitled "The Madrasa" and dated 1859, thought fit to include a curious structure on the roof of a neighbouring house. The more we look at this brown object we see that it has the shape and the orientation of the wind-catchers described in medieval Egyptian astronomical texts.

A scene such as this, painted over 150 years ago, gives a faithful rendering of what a *madrasa* class in Cairo might have looked like. Some followers of Edward Said think these paintings give a false idea of what life was like in the old days. According to the American writer Philip Metres: "Orientalism involves a way of seeing the other (the Arab) that justifies an ongoing system of domination." Before accepting this for orientalist painters one should look at the works they created from scenes in contemporaneous Europe.

Philip Metres, "Same As It Ever Was: *Orientalism* Forty Years Later", at http://arabstereotypes.org/blog/201801/25-437.

www.sothebys.com/en/buy/auction/2019/important-works-from-the-najd-collection/frederick-goodall-the-madrasa.

F15

This imposing painting "Streets of Cairo" is the work of the British architect and artist Owen Browne Carter (1806-1859). Around 1830, in the company of Robert Hay (see Pls. F6-7), he went to Cairo, where he made a large number of architectural and topographical drawings. Now just what is the wooden frame on the roof of the richly-decorated building in the middle?

Whatever it was, it looks defunct, cast aside, precariously close to the edge of the roof, no longer serviceable even for hanging out laundry. And it looks rather small for a main-frame of a *bādahanj* on such a substantial house and too wide to serve as a ladder. Did Carter know what it was? What did he think it was? What was it?

https://i.pinimg.com/originals/4e/86/c6/4e86c6470c8100a54991a91ec67c924c.jpg

G: A famous Italian photographer

“(These) photographic images of the Middle East provide a valuable resource for the study of the Middle East. ... Despite the potential value of early photography to the field of Middle Eastern studies, its importance has yet to be fully recognized, since scholars of many disciplines concerned with this region are largely unaware of the wealth of visual documentation available ... .”
Paul Chevedden, “Early photography of the Middle East” (1984), pp. 152.

“Surprisingly, the invention of photography in 1839 did little to contribute to a greater authenticity of painterly and photographic representations of the “Orient” by artists, Western military officials, technocrats, and travellers. Instead, photographs were frequently staged and embellished to appeal to the Western imagination.” Nancy Demerdash, “Orientalism” (2015).

The reader can count how many of the following photos in Sections G-M are staged or embellished.

G1

How rare are early photos of Cairo featuring real people! Really "Le Caire sur le vif", as in the title of a 2017 exhibition in Paris on the works of the Italian photographer Beniamino Facchinelli (1875-1895). The top of the roof of a wind-catcher is visible at the centre of the photo, partly hidden by a wooden structure. The top resembles the one which survives on the al-Jawhara Palace on the Cairo Citadel – see Pl. Q11.

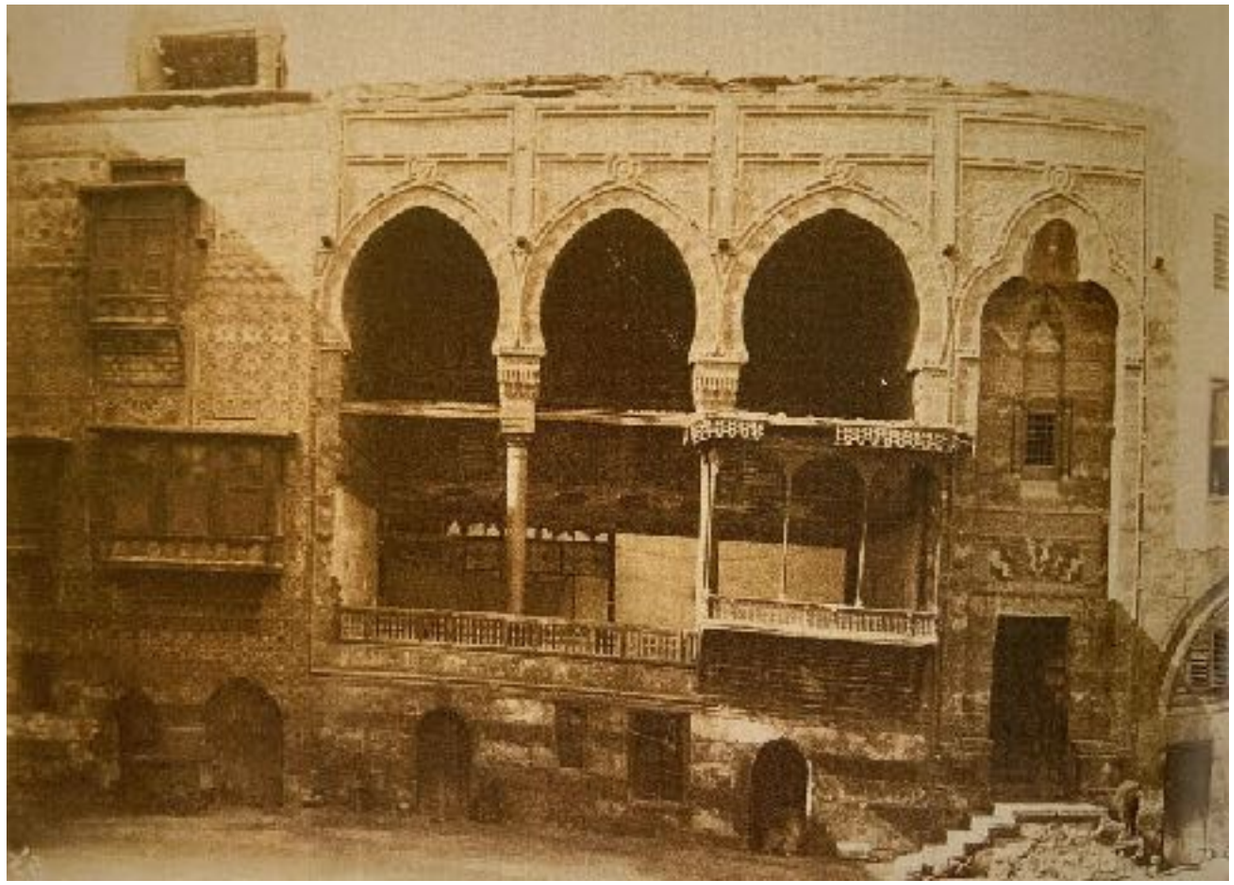
Ola Seif, "The lens of Biniamino Facchinelli".

G2

In this detail of a photo of the Mosque of Qāyitbāy by Facchinelli, published by him in 1887, there are three simple wind-catchers on the roofs of adjacent houses.

Beniamino Facchinelli,
Raccolta artistica di fotografie sull'architettura araba, ornati ecc. dal XII° al XIII° secolo **(1887) (detail).**

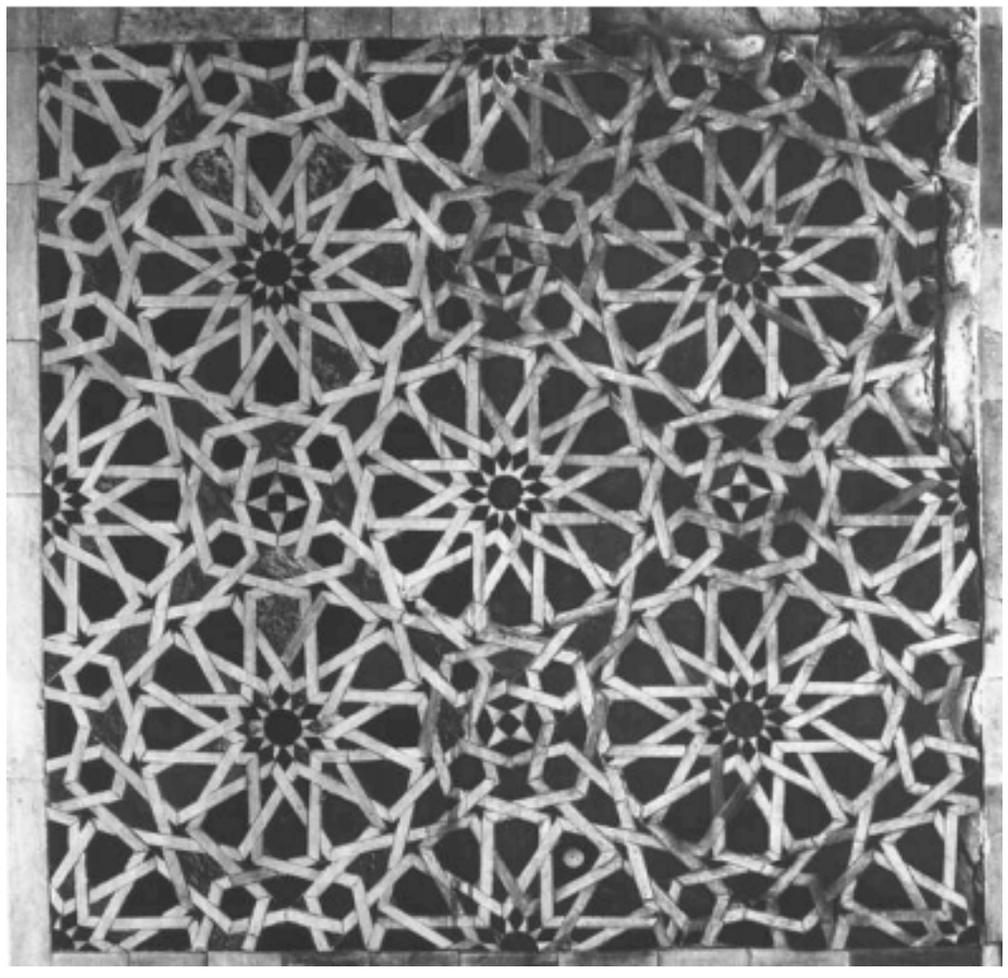
G3



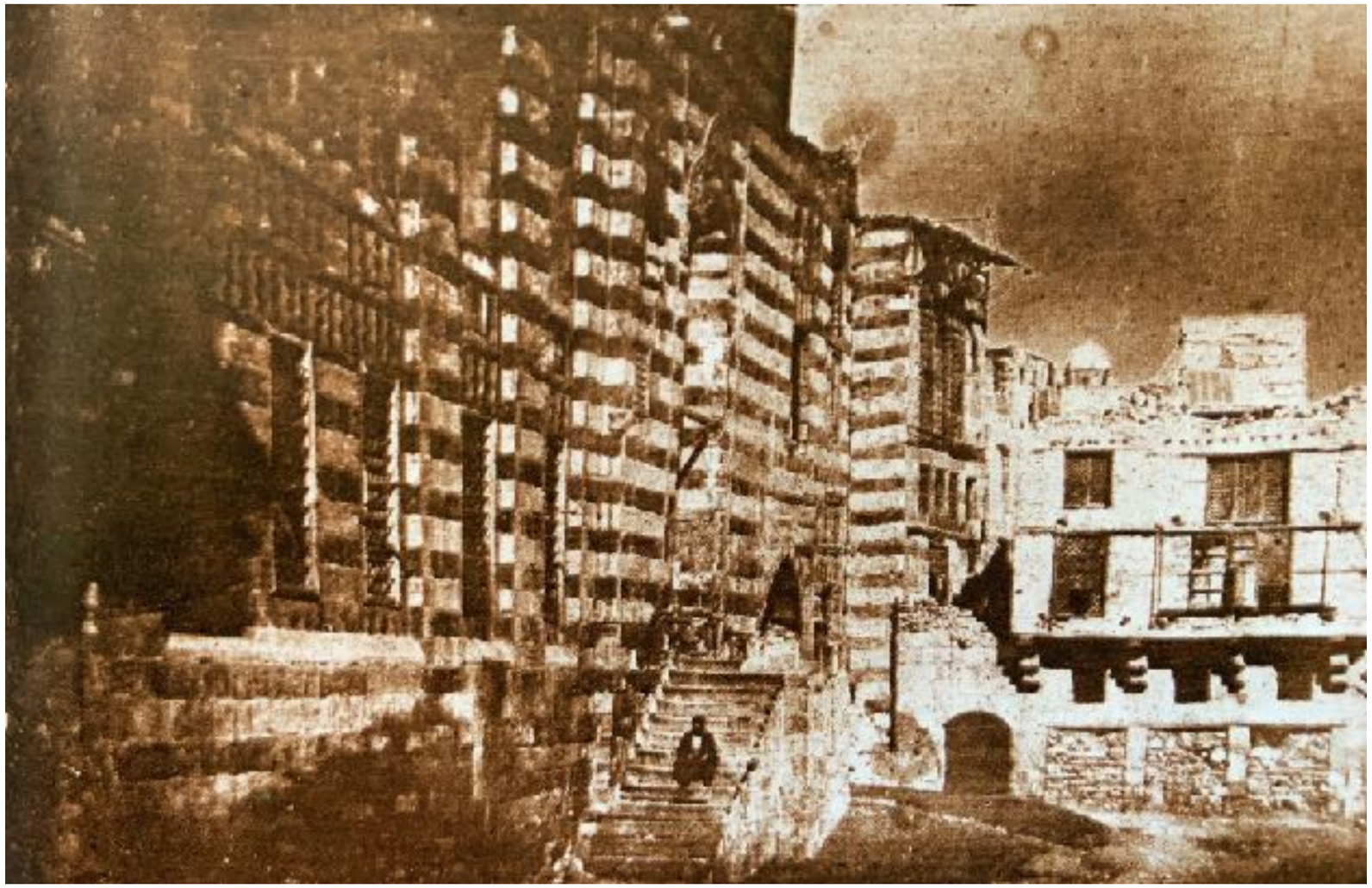
Facchinelli captured this *maqʿad* or place to entertain guests overlooking the courtyard of the house of Sultan Qāyitbāy. Notice the wind-catcher on the upper left.

Ola Seif, “The lens of Biniamino Facchinelli”, p. 204.

H: French photographers



See Pl. D14.



A photo attributed to Joseph-Philibert Girault de Prangey (1804-1892): “Vieille place au Caire”. The contraption on the upper right may be the back of a wind-catcher.

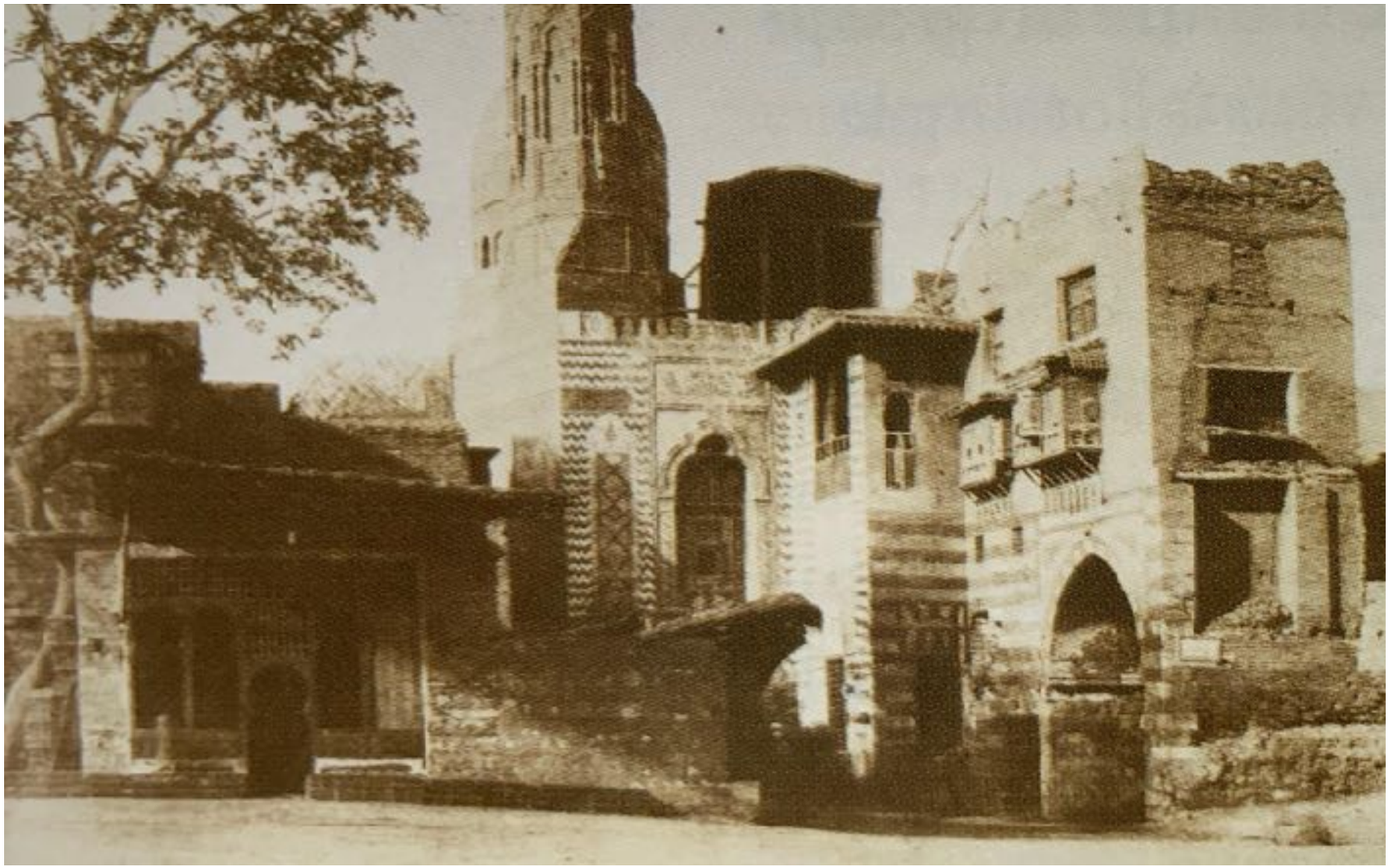
Hélène Bocard, “L’époque des amateurs : 1839-1860”, p. 166.

H2

The French writer and journalist, Maxime Du Camp (1822-1894), better known as the friend and companion of Gustave Flaubert, has left us this detailed photo of the roofs of the Cairo he saw from al-Ghawriyya Mosque and *Madrasa*. At least seven wind-catchers can be seen and the upper part of the *mashrabiyya* on the right seems also to serve as a wind-catcher.

From https://journals.openedition.org/inha/docannexe/image/4880/img-4.jpg.

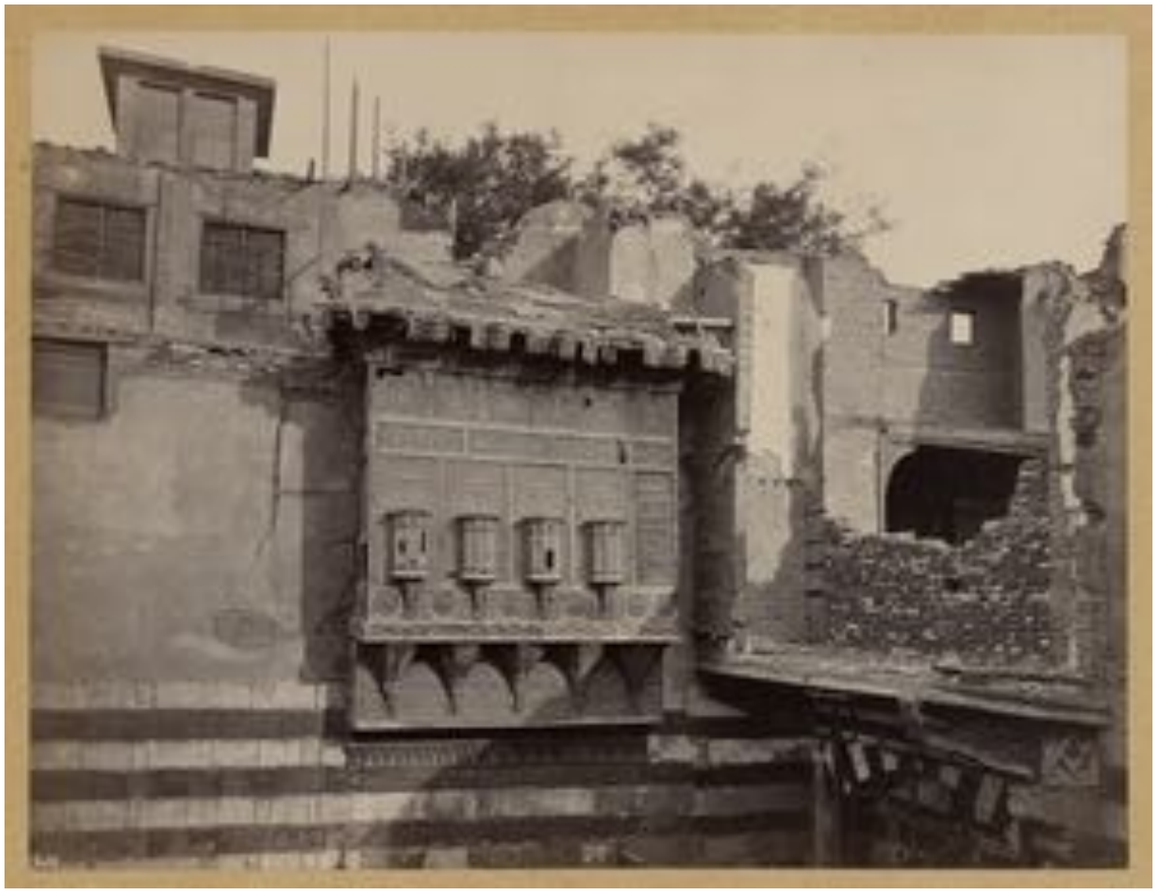
H3



A photo by Félix Teynard Bocard (1817-1892) of the Mosque of Bulaq. Notice the very large wind-catcher in the middle of the photo.

Hélène Bocard, “L’époque des amateurs : 1839-1860”, p. 166.

H4



Two photos by the French photographer M. Martinet, taken in the period 1850-80.

Perhaps the construction on the roof to the left is part of wind-catcher?

www.getty.edu/art/collection/artists/2664/

Two very strange protrusions above a substantial portal on a Cairo street. They have nothing to do with ventilation.

www.getty.edu/art/collection/objects/64702/

H5

The Frenchman Félix Bonfils (1831-1885) was one of the first photographers to produce images of the Near East on a large scale commercially. This view toward the Citadel from *ca*. 1875 shows but few remaining *malqaf*s.

https://shapero.com/shop/bonfils-felix-le-caire-citadelle-et-village-arabe-1880/

H6

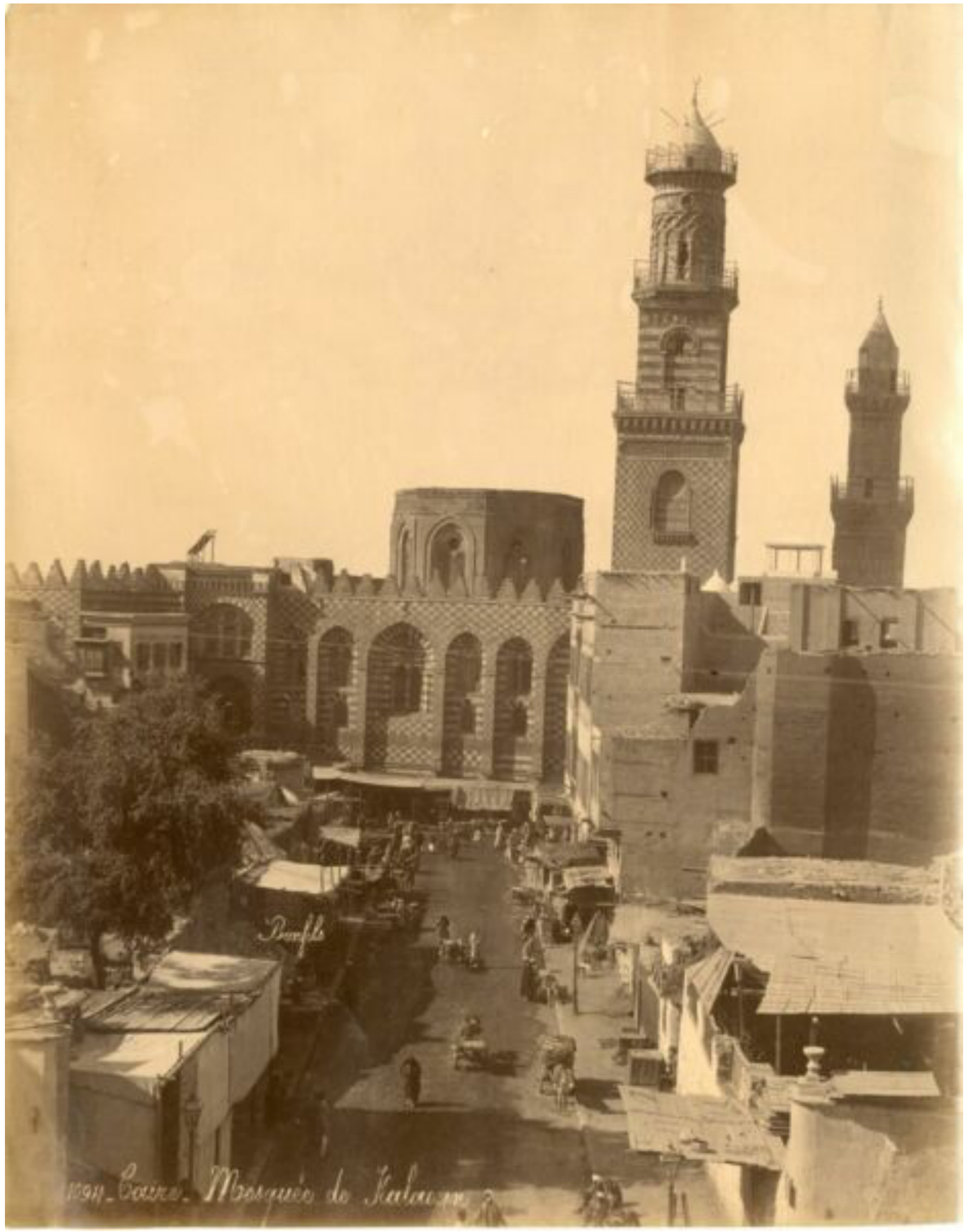
This Coptic “Quartier de la Citadelle” is quite a way from the Citadel. Here Bonfils enables us to look over the roofs of houses which once sported a *malqaf*. Several houses have simply a hole in the roof as a reminder of more prosperous days. A few of the devices can still be seen.

www.ebay.it/itm/Bonfils-Egypte-Le-Caire-Quartier-de-la-Citadelle-Vintage-albumen-print-Feli/351811687600?hash=item51e99c54b0:g:oUYAAOSw2CJap~Q0

H6a

Bonfils, “Le Caire, vue générale 69”, with the Madrasa of Umm al-Sulṭān Shaʿbān in the distance. On the far left, and elsewhere, several rather new-looking *bādahanj*es can be seen.

Maryse Bideault, *L’iconographie du Caire dans les collections patrimoniales françaises* (2010), p. 155
(original in Montigny-le-Bretonneux, Médiathèque de l’architecture et du patrimoine)



Where have all the *malqaf*s gone?
Long time passing …

On this photo by Bonfils of the area around the Mosque of Qalāwūn a solitary *malqaf* is still to be seen in the distance.

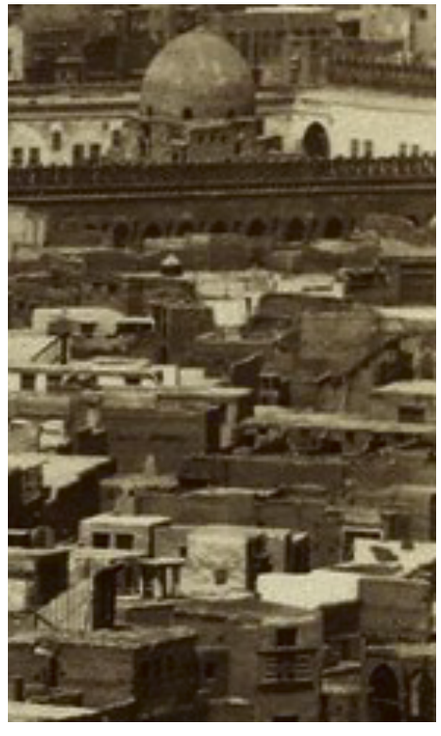
www.prodottitop.com/?q=BONFILS

H8

It was *de rigueur* in those days to take a photograph from the Citadel. This is one by Bonfils. It would be interesting to have more historical evidence about the proliferation of *malqaf*s here; alas we have only the photos.

www.getty.edu/art/collection/objects/200245/felix-bonfils-le-caire-pris-de-la-citadelle-french-about-1878/?dz=0.5648,0.3846,1.23

H8a



A panorama of Cairo from 1870 by the French photographer Emile Béchard (1840-1891). This view from the Citadel stretches from the Pyramids on the left to the Mosque of Ibn Ṭūlūn on the right. There are many *malqaf*s visible since the quality of the image is superb, but alas it cannot be replicated in this copy and these extracts. See also Pl. H8b.

https://www.flickr.com/photos/photohistorytimeline/24874173114.

H8b

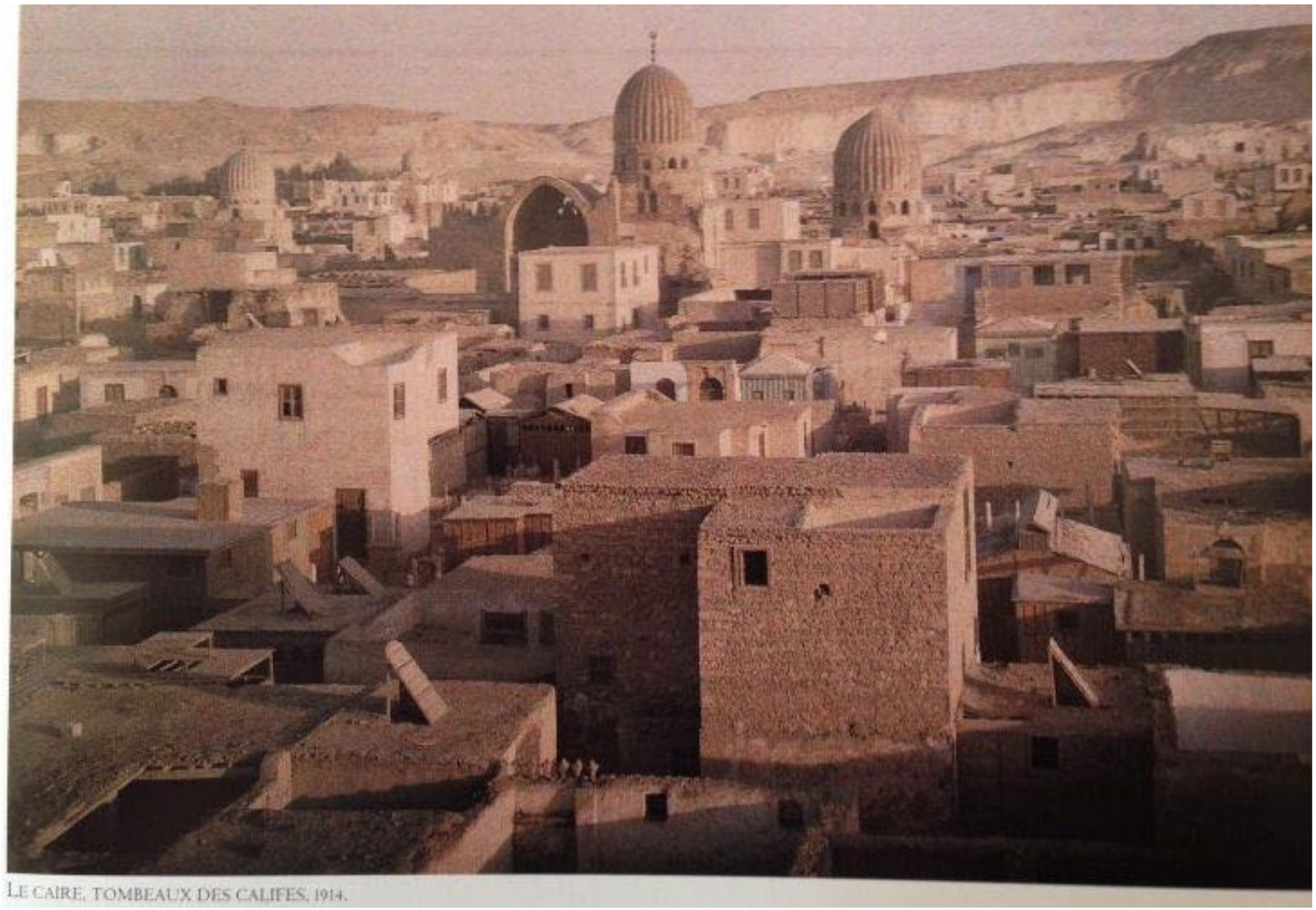
Above: The *malqaf*s below the Citadel in the panorama of Emile Béchard (Pl. H8a).

Left: A separate photo of a different set of *malqaf*s, also by Béchard.

It would be interesting to have some textual evidence about the construction of these particular devices. They seem to reflect a manic enthusiasm for fresh air but a laudable reliance on *malqafs* as a means for providing it.
Whose idea was it to put up so many?
Why? & When?

www.gazette-drouot.com/lots/5310401
http://cielvariable.ca/en/artistescv/bechard-emile-en/.

H9



LE CAIRE, TOMBEAUX DES CALIFES, 1914.

A photo from 1914 by Auguste Léon (1857-1942) of the necropolis of Qāyitbāy. Numerous rather simple wind-catchers facing north are visible.

Bammate, *Cités de l'Islam* (1987).

H10

A sublime view of the “Tombs of the Caliphs” around 1870-1880 taken by Félix Bonfils.

http://scribeaccroupi.fr/exposition-le-voyage-illustre-d-emile-guimet-en-asie/.

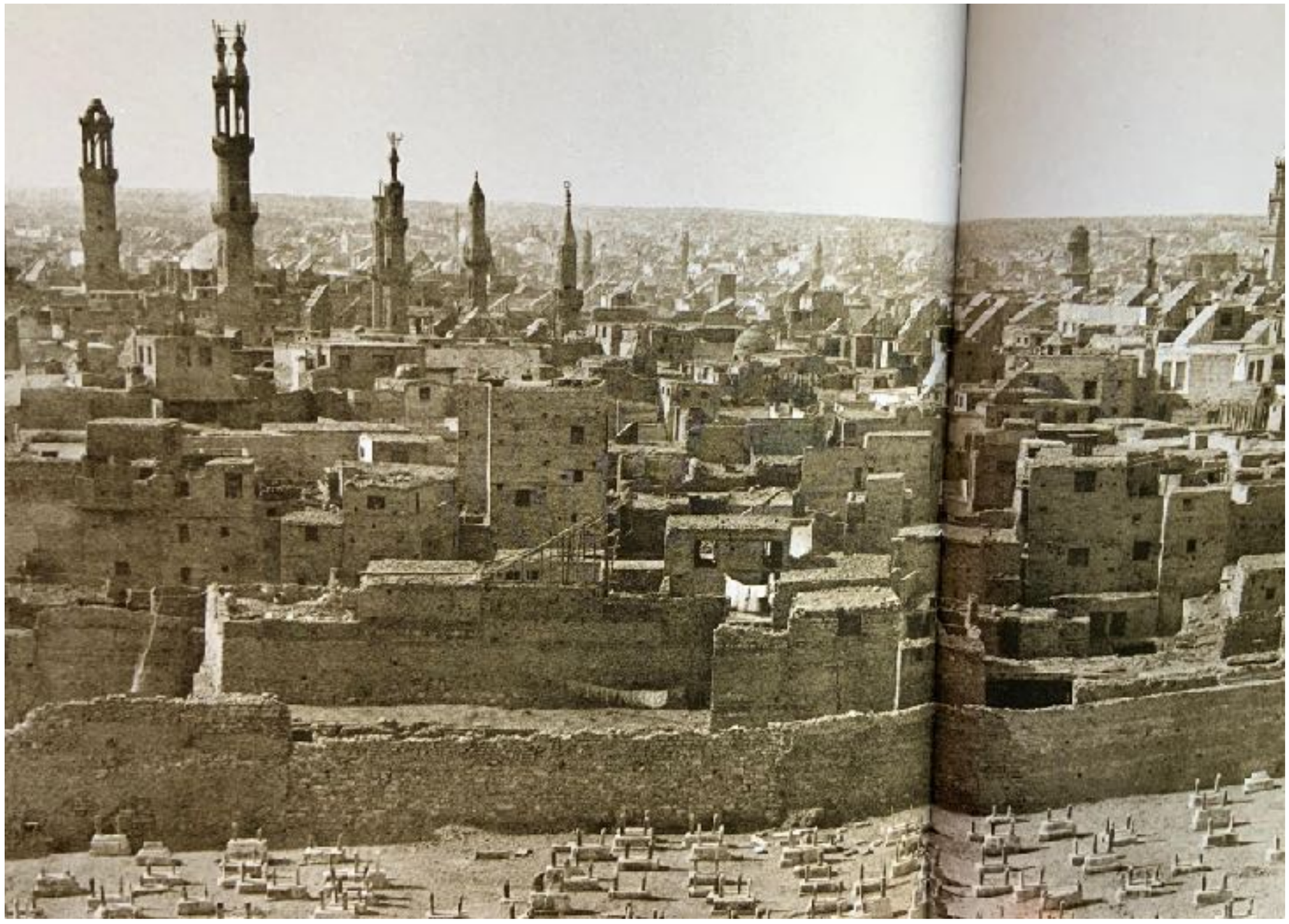
H11

An image by an anonymous French photographer of an unidentified and most unusual monument in the Northern Cemetery, that is, the region of the Tombs of the Caliphs. In the distance on the left are several substantial *bādahanj*es.

Maryse Bideault, *L'iconographie du Caire dans les collections patrimoniales françaises* (2010), p. 128 (original in Paris Ensba).

J: German and Swiss photographers

J1

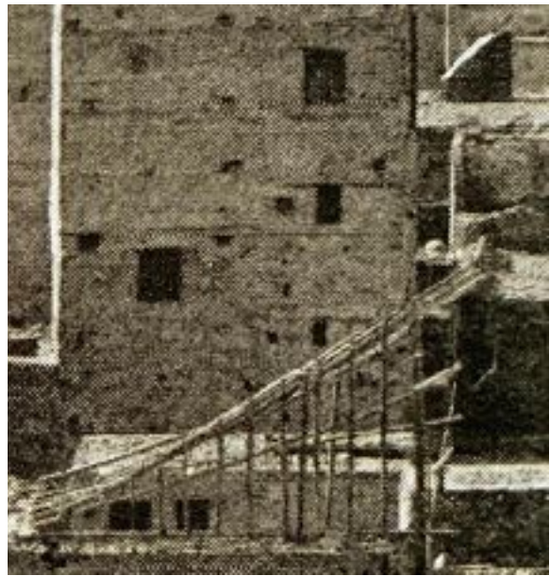


The right-hand side of the photo by Jakob August Lorent (1813-1884), over the East Cemetery in the foreground towards the al-Azhar Mosque on the left – see also the next Plate. There are wind-catchers galore to be seen.

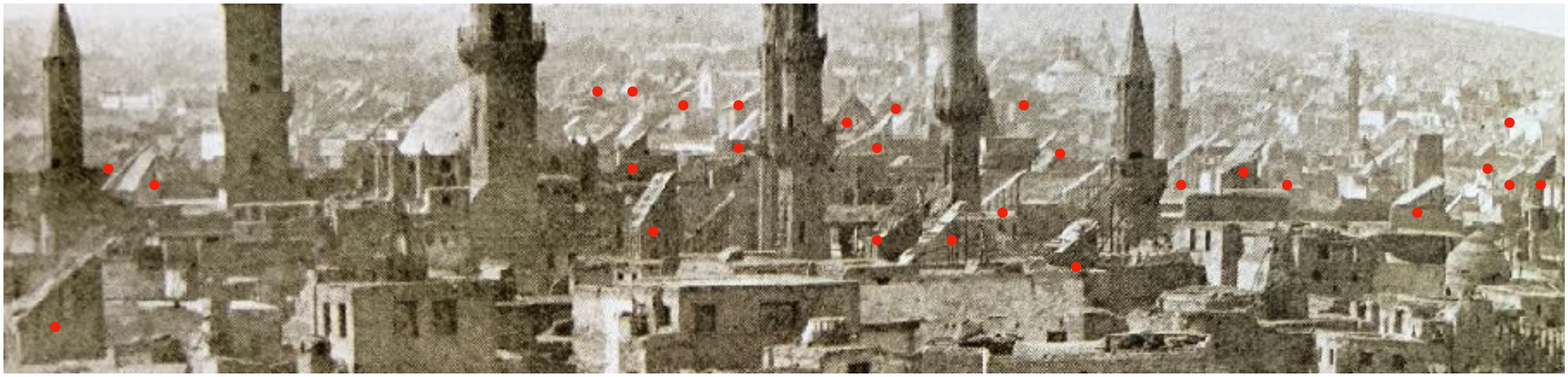
From A. Lorent, *Egypten,* … , Mannheim, 1861.

Volkoff, *1000 Jahre Kairo* (1984), pl. 3.

J2



J. A. Lorent



In the background there are more than two dozen wind-catchers still in action, whereby verily *l'un peut en cacher un autre*. In the foreground there are two skeletons of defunct wind-catchers.

Details of the previous plate.

J3

**Lorent's panorama extends on the right to the Qalāwūn and Barqūq Mosques.
The wind-catcher at the centre is on the roof of a mosque.
Dozens of other such devices are visible in the background.**

From A. Lorent, *Egypten,* … , Mannheim, 1861. **Volkoff, *1000 Jahre Kairo* (1984), pl. 3.**

J4

The dome of the Mosque of the *amīr* Qawṣūn (1329/30) photographed by Wilhelm Hammerschmidt *ca*. 1858. One of the most important 14th-C Mamluk monuments in Cairo, it was pulled down in 1873 to make way for the Boulevard Muhammad Ali (now Shariʿ al-Qalʿa). This photograph is therefore of considerable historical importance. There are *bādahanj*es everywhere. Imagine two or three times as many *bādahanj*es as one sees here in order to have some idea how the Cairo skyline looked centuries ago.

W. Hammerschmidt, *Monuments de l'Égypte ancienne et moderne* (1860), from Paul Chevedden, "Early photography of the Middle East" (1984), p. 161.

J5

This spectacular photo of Cairo from an altitude of 800 meters was taken by the Swiss aviator and photographer Walther Mittelholzer in 1926/27 on the first flight from Europe (Zurich) to Africa (Capetown). There are no wind-catchers to be seen anywhere around the Mosque of Ibn Ṭūlūn, but a couple of them can be seen below the Citadel. Centuries earlier there would have been wind-catchers to be seen in profusion.

www.theguardian.com/cities/gallery/2017/jul/05/1930s-cities-from-the-air-aerial-photographs-walter-mittelholzer-in-pictures#img-1, from ETH-Bibliothek, Bildarchiv, Zurich.

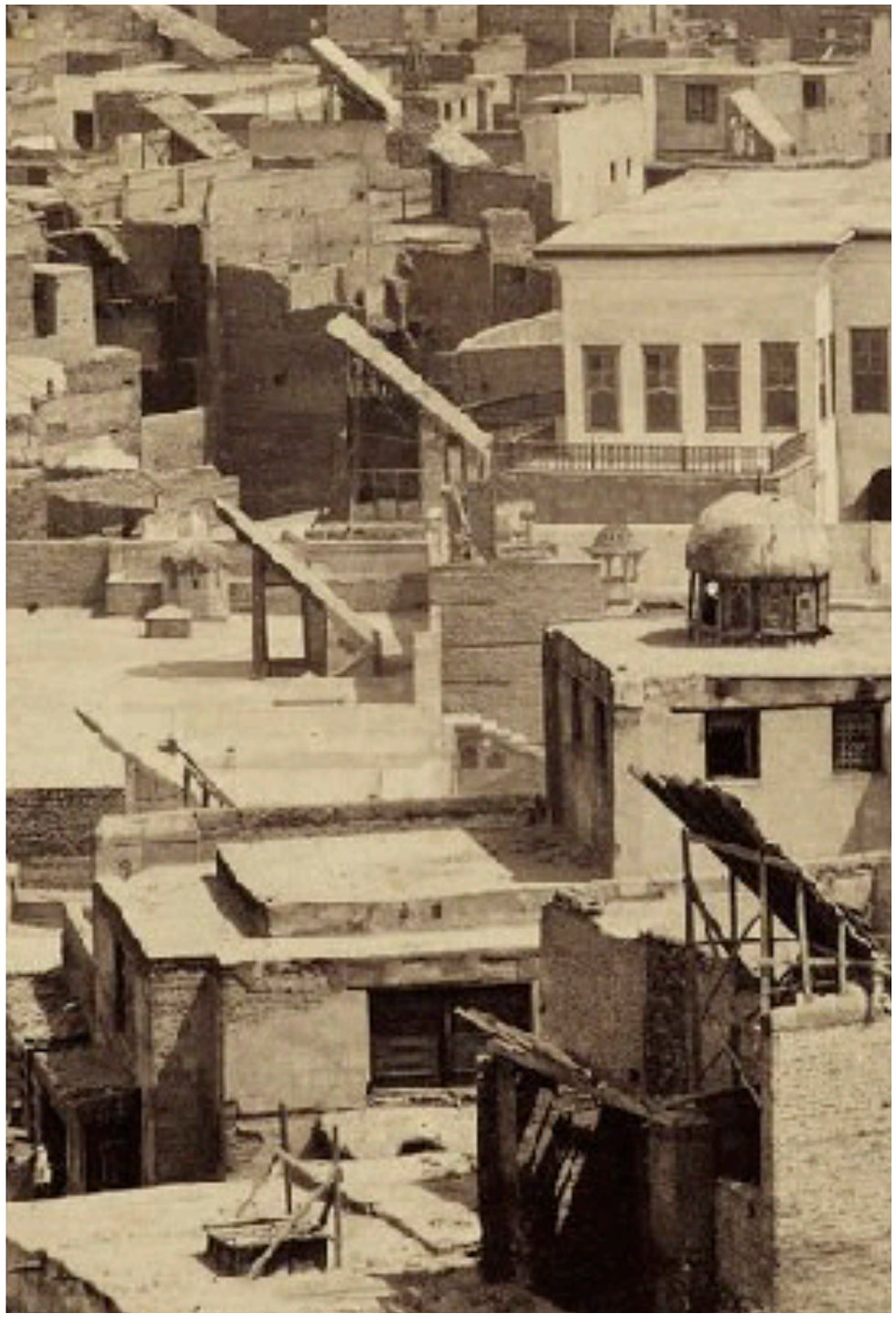
K: English photographers

K1

A remarkable photograph taken in 1862 by Francis Bedford (1815-1894) from the minaret of the Mosque of Ibn Ṭūlūn looking over toward the Citadel. There are wind-catchers galore to be seen, in various shapes and sizes. See the details on the next Plate.

www.rct.uk/collection/search#/8/collection/2700903/the-citadel-of-cairo-from-the-tayloon-mosque-citadel-from-the-mosque-of-ibn-tulun, courtesy of the Royal Collection, London (rct.uk).

K2



Some of the wind-catchers caught by Francis Bedford *ca*. 1862. Most seem to be be open on the western side, some also on the eastern side. The one to the left of the top of the palm tree on the left reveals that wattle was used to cover the palm-tree trunks to form the sloping surface of the wind-catchers. Other examples shown here are less substantial and look a bit rickety.

K3

The English photographer Francis Frith (1822-1898) took numerous shots of Cairo *ca*. 1860. His favourite view seems to have been that from the Citadel toward the Mosque of Sultan Ḥasan, showing a plethora of *malqaf*s in the foreground.

K4

More of the same by Francis Frith.

https://en.muzeo.com/art-print/170812/francis-frith

https://en.muzeo.com/art-print/cairo-from-the-citadel/francis-frith

L: More views from the Citadel

L1

The engraving published by Georg Ebers (Pl. E8) shows this scene before all these wind-catchers were installed. Even the author of the present study would agree that there are too many (اكتر من اللازم or كتير اوي) wind-catchers shown in these views from the Cairo Citadel *ca*. 1900.

L2

L. Hautecoeur & G. Wiet, *Les Mosquées du Caire* (1932).

Photo courtesy of Olivier Jaubert.

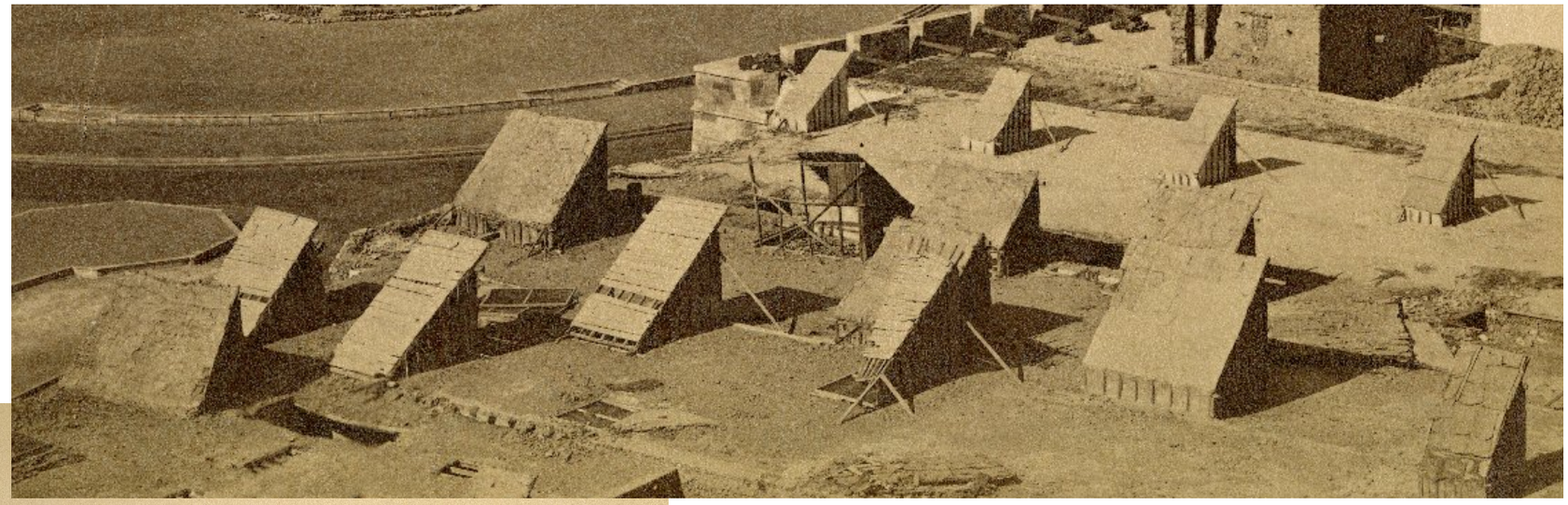
© DAI

Some rare views inside the arsenal in the Cairo Citadel showing the workshop hall with timber roof construction and a wind-catcher. On the right, the former gun foundry.

© DAI

[Bodenstein *et al.*], "Industrial architecture in Egypt in the 19th and 20th centuries" (*ca*. 2008).

L3



An anonymous late 19th-C photo, elsewhere* attributed to Pascal Sébah.

* www.rct.uk/collection/2581386/cairo-egypt

http://luna.wustl.edu:8180/luna/servlet/detail/19Cent~16~7~155640~123461, courtesy of Washington University, St Louis MO, LUNA collections.

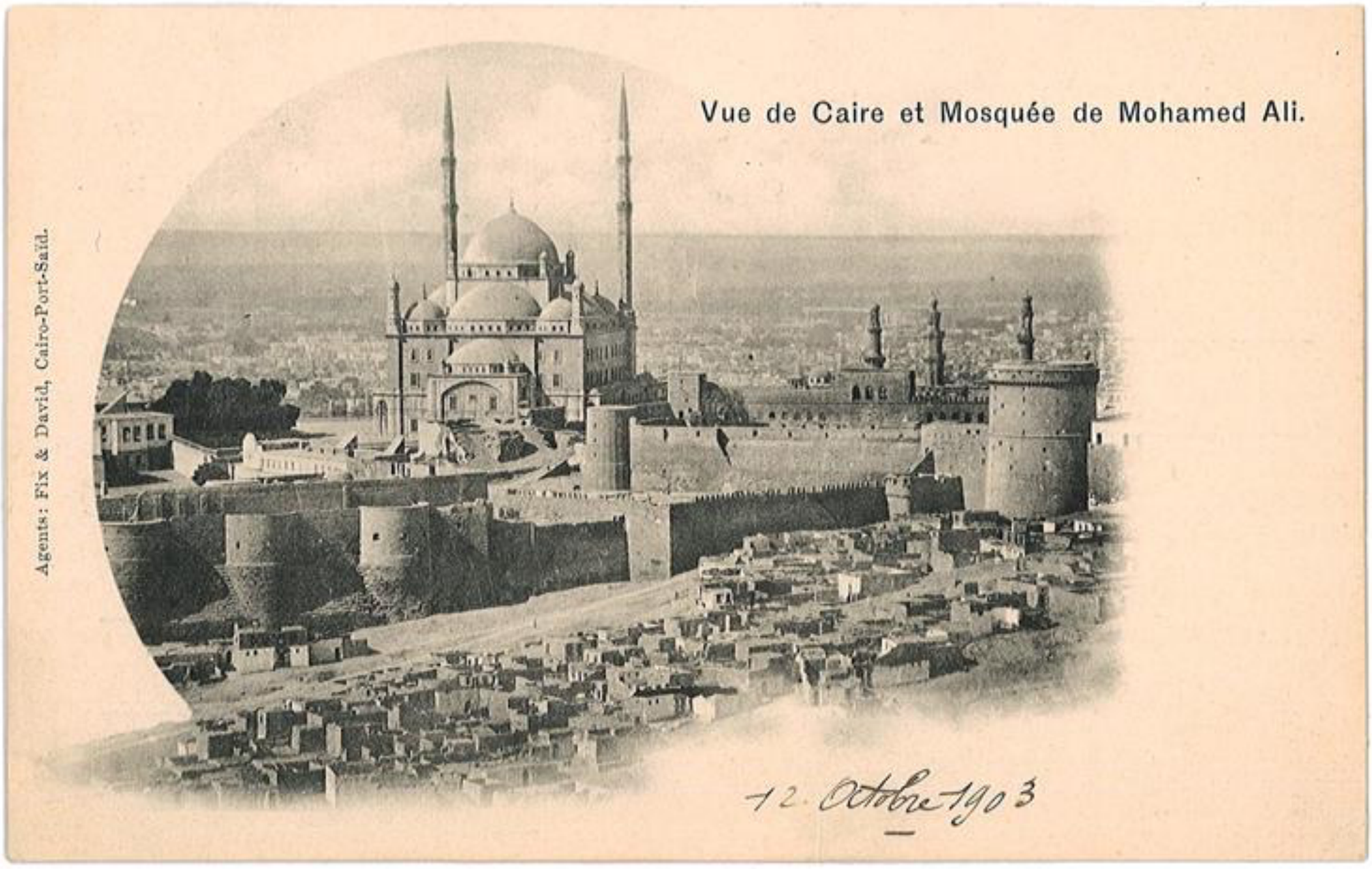
بدون تعليق

L4

de.123rf.com.jpeg

The recent photo of a Cairo rooftop shows two traditional wind-catchers in the upper left and right. The series of small square roofed pavilions open on each of four sides serve as skylights (Egyptian Arabic *shoksheka*). The 'photo' on the right is a fake.

L5



A post-card sent in 1903 showing two wind-catchers near the Muḥammad ʿAlī Mosque.

L6

Collection of Dr Paula Sanders, Rice University, from https://scholarship.rice.edu/bitstream/handle/1911/5550/EgyV7_0010r_e.jpg?sequence=2&isAllowed=y.

L7

The Greek brothers Constantin and Georges Zangaki were photographers active in Egypt (based in Port Said) between 1870 and 1900 who specialised in sites of Ancient Egypt. Fortunately they also took this shot of the Citadel of Cairo from below. Some *malqaf*s are visible from this side too, just.

http://scribeaccroupi.fr/exposition-le-voyage-illustre-d-emile-guimet-en-asie/

L8

A identifier

A solitary *malqaf*, albeit accompanied by a *shakhshoukha* or roof-pavilion.
The pair are situated on the roof of what was formerly a private house.
Notice that there is an opening on the western side of the *malqaf*.
Location within Cairo unknown.

Jaubert, Rapport d'activité, Bourse IFAO, février 1996 et mars 1997, photo courtesy of Olivier Jaubert.

M: A Turkish and an Armenian photographer

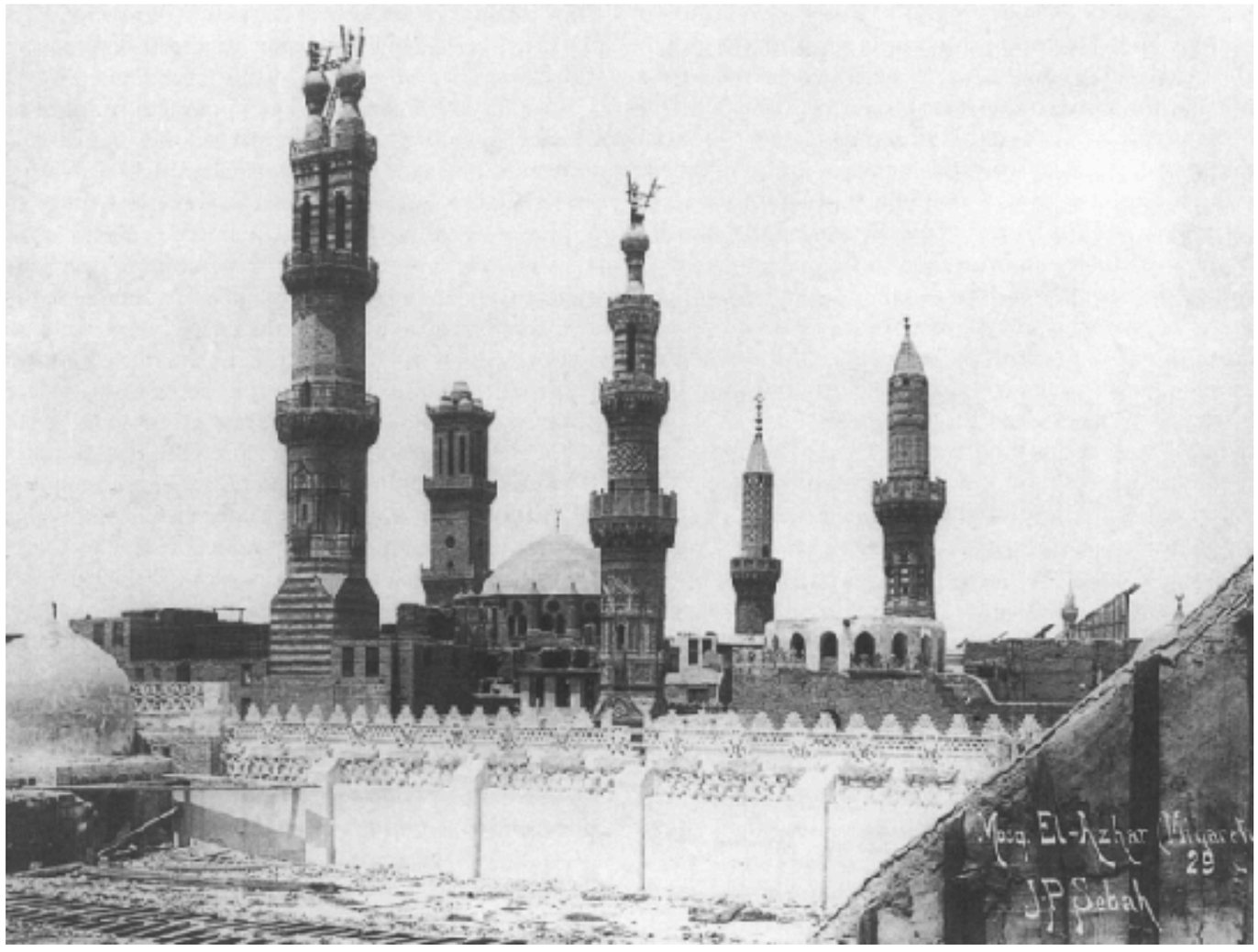
M1


AntiquePhotoWorld

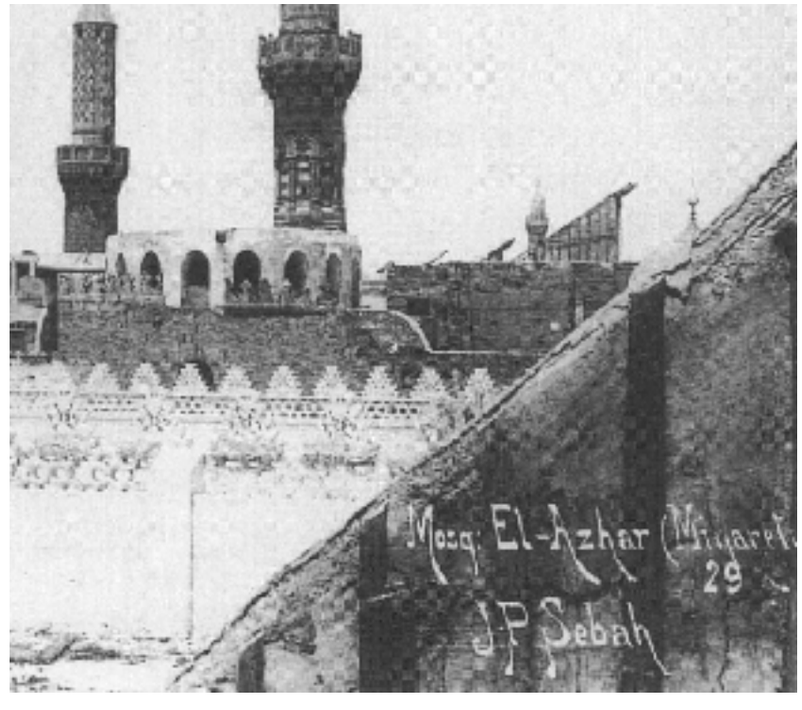
This photo by the Turkish photographer J. Pascal Sébah (1830-1910) shows a considerably diminished number of wind-catchers, except in the upper left.

J. Pascal Sébah, *Comparative views of Egypt*, 1870, pl. 31, also on AntiquePhotoWorld.com.

M2



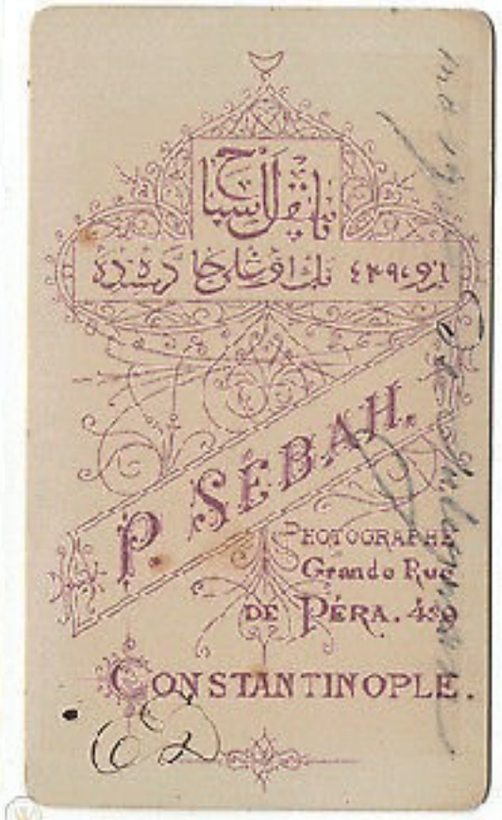
A historical source here presented for the first time in Part I informs us that when the al-Azhar Mosque was built in 970 there was a *bādahanj* by the side of the *minbar* or pulpit. All of the serious *bādahanj*es that once graced the Mosque are gone.

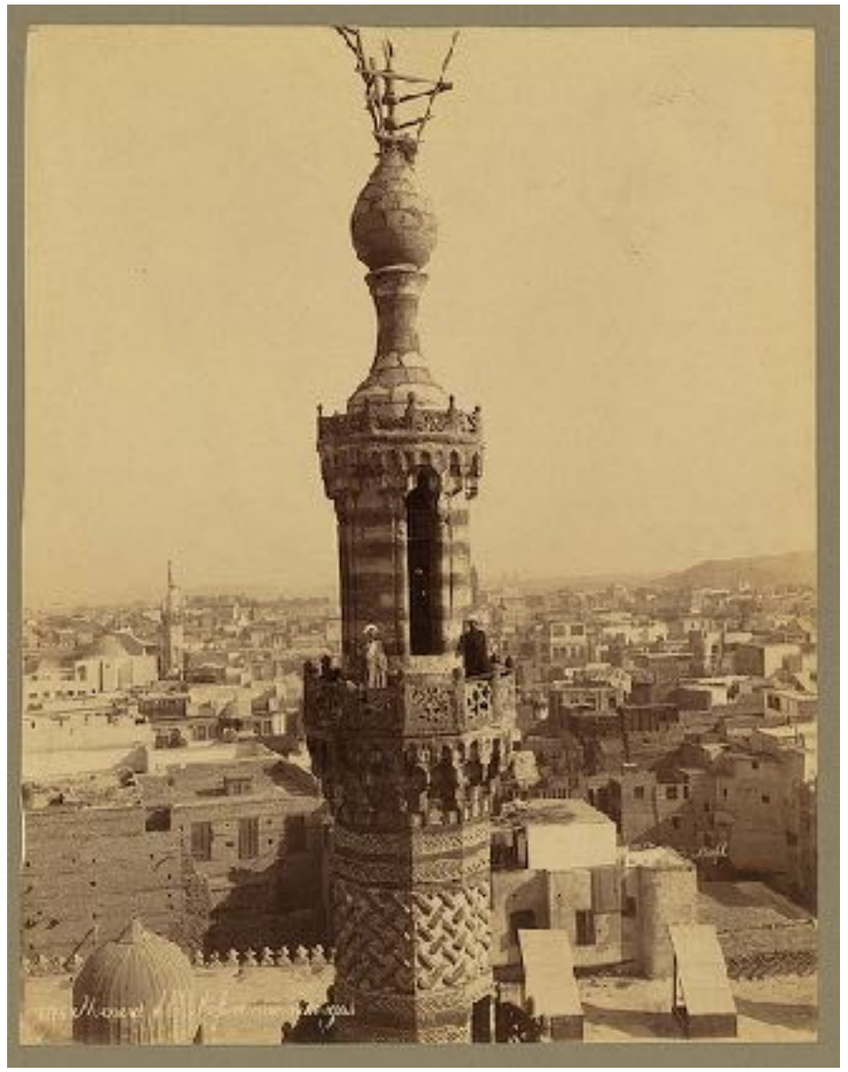


An unusual photo of the al-Azhar Mosque taken by J. P. Sébah around 1887. In the distance on the right are some substantial wind-catchers. Sébah has signed his photo on the side of one such! The east sides are closed, as they should be, and the west sides cannot be seen.

Photo from Nasser Rabbat, "Al-Azhar Mosque" (1996), p. 60.

M3





Given Sébah's penchant for capturing wind-catchers I suspect that these remarkable photos are by him. Unlike most images of the al-Azhar, the *bādahanj*es here are shown in good shape; indeed, they have clearly recently been replaced. What is perhaps surprising is the fact that the materials used for the roof and the east side of each *bādahanj* are apparently so insubstantial.

https://picryl.com/media/minaret-del-azhar-avec-muezzins-bonfils

M4


AntiquePhotoWorld
antiquephotoworld

This is the only photo known to this author in which six *bâdahanj*es, the closest rather beaten up, are in the foreground rather than in the photo by accident. This time it is the al-Azhar minarets that are in the background. Sébah really took trouble with this photo: notice there is another, larger wind-catcher in the distance on the right.

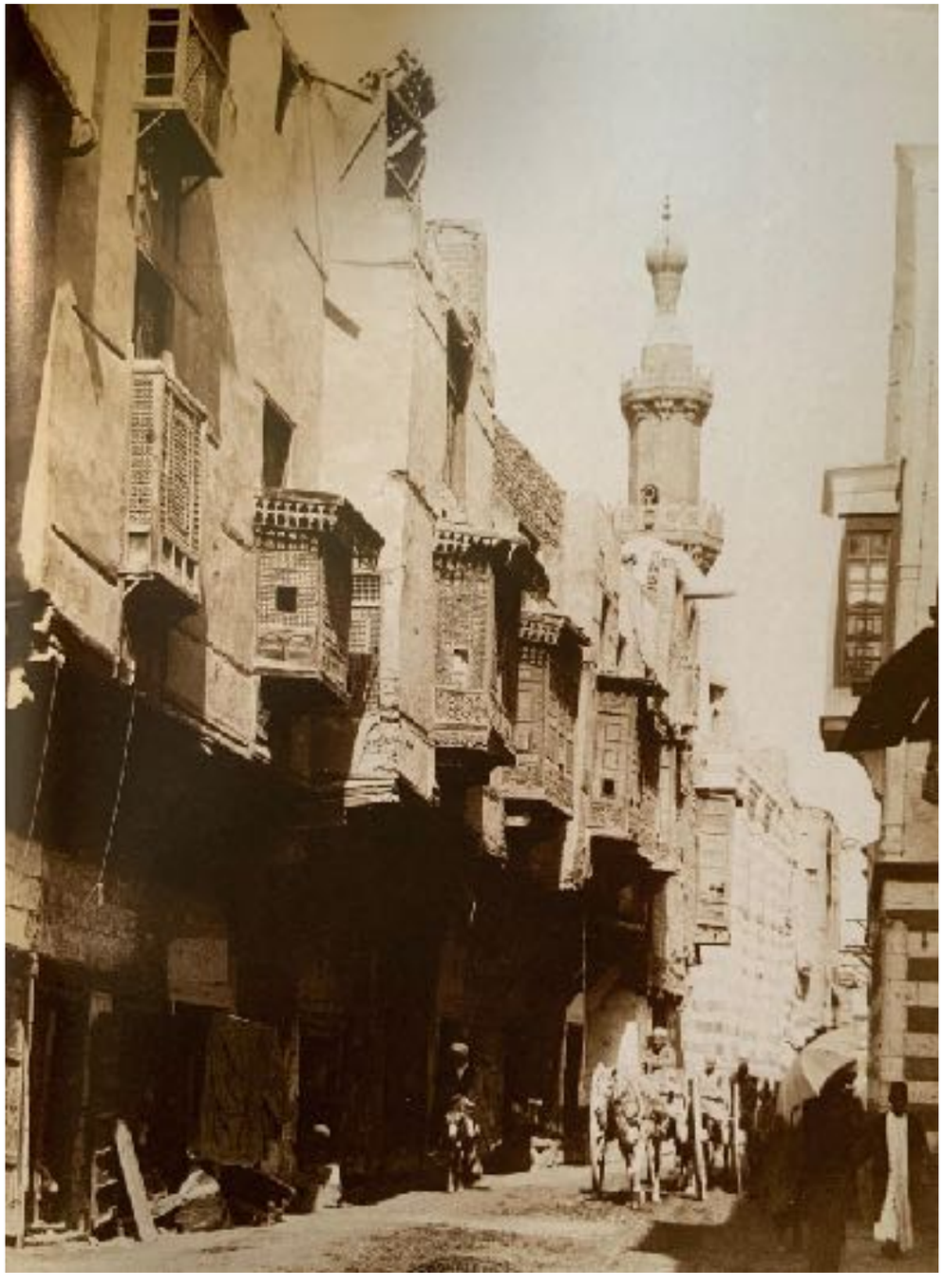
www.worthpoint.com/worthopedia/al-azhar-mosque-cairo-egypt-antique-401908415.

M5

This fine photograph of the minarets of the al-Azhar Mosque by the Armenian Egyptian photographer Gabriel Lagekian *ca*. 1900 shows three wind-catchers in the foreground, of which the one at the back is in a state of collapse.

A similar shot by K. A. C. Creswell a few years later concentrates on the minarets.

M6



Gabriel Lekegian took this photo of the street of the Bāb al-Shaʿriyya around 1890-1900. Notice the unwieldy structure on top of one of the buildings on the left. It gives to believe that it might be some kind of wind-catcher, surely less effective than most.

Thomas Cazentre, "Photographies du Caire – les ateliers commerciaux" (2013), p. 237.

M7

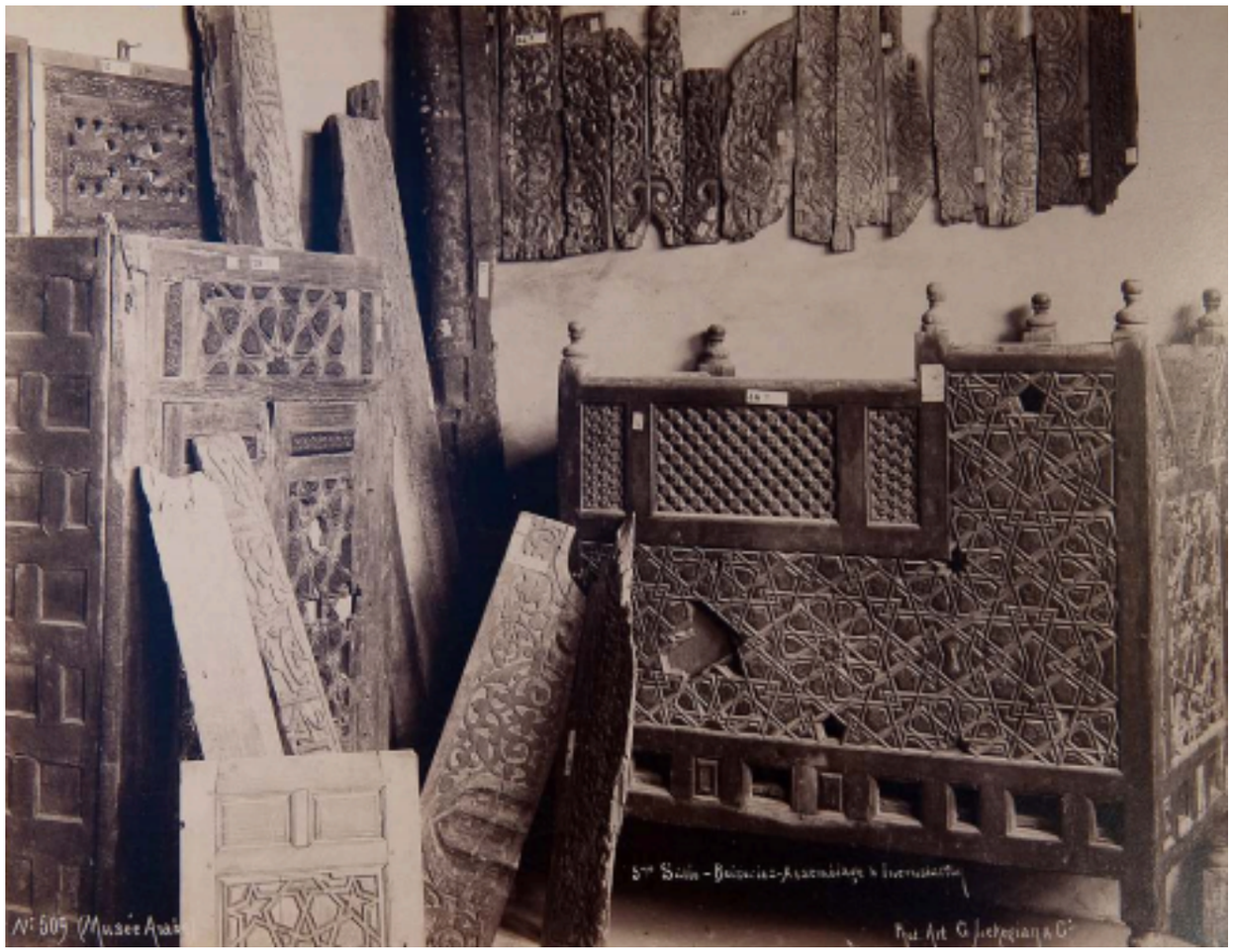
This street in Bulaq captured by Lekegian shows not a single wind-catcher on the roofs. However, in Bulaq streets were not necessarily aligned in the same direction as the Fatimid city, so any wind-catchers would not necessarily be aligned with the houses below.

M8

Another photo by Lekegian, dated between 1887 and 1908 and showing houses along the *Khalīj* or Red Sea Canal which defined the lay-out of the Fatimid city. None of the houses features a wind-catcher, a major disappointment for this author, but these are not medieval houses.

Courtesy of the Victoria & Albert Museum, London, https://collections.vam.ac.uk/item/O1298358/.

M9



Lekegian thoughtfully took this photo (no. 509 in his Cairo series) of decorated wood remnants in the fifth "Salle Boiseries-Assemblage & Incrustation" of the then Musée arabe in Cairo. Parts of *Qur'ān* stands, lecterns and pulpits repose together with more mundane items such as cupboards and *mashrabiyya*s. Alas the scoops of wind-catchers were not decorated so they were generally abandoned and would never end up in a museum, although several could be seen in their final resting place on the roof of the al-Azhar Mosque – see Pl. D16.

Maryse Bideault, *L'iconographie du Caire dans les collections patrimoniales françaises* (2010), p. 145 (original in the Bibliothèque de l'INHA, Paris).

M10

A view by Lekegian of the city from Sultan Ḥasan Mosque on the left to the Citadel and the Mosque of Muḥammad ʿAlī on the right.

Not a single *malqaf* is to be seen.

Were there hundreds in this region in medieval times? If so, when were they removed? Or when did people stop maintaining them? Or were there never any in this particular region? All of the images presented in this corpus could be further analyzed to investigate the distribution of *malqaf*s in the different parts of the city, but the images represent only the meagre remains of a large banquet and the medieval city has almost disappeared anyway.

N: Miscellaneous views and post-cards

**“Don’t sleep in the *bādhanj*
For there is no medicine for those made sick by it.
The individual that steals passion (air)
At night is not safe.”**

The 14th-C poet Ṣadr al-Dīn ibn ʿAbd al-Ḥaqq.

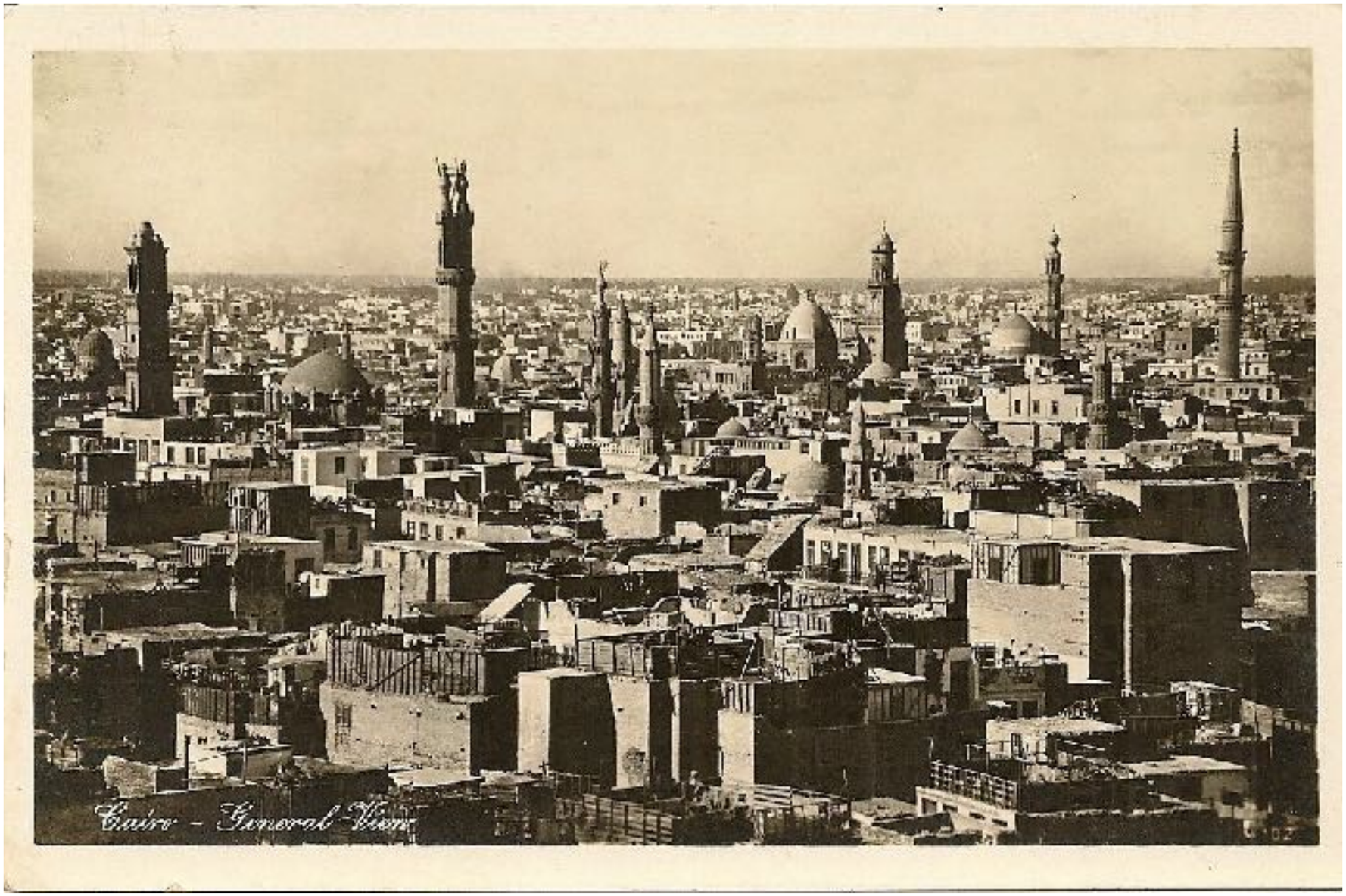
N1

An unsigned image of the *Khalīj*, the Canal which formed the western limit of the Fatimid city, apparently dated 1884.

There are no wind-catchers visible.

Source: www.pinterest.com/pin/696650636081653279/.

N2



Occasional wind-catchers are still to be seen on the roofs of domestic architecture in Cairo in this post-card from *ca*. 1900. A fenced enclosure on the roof had apparently become popular.

N2a

CAIRO.

Numerous wind-catchers are still to be seen on this 1901 post-card.

https://images.app.goo.gl/h6LjAHKyWc8gqjW18

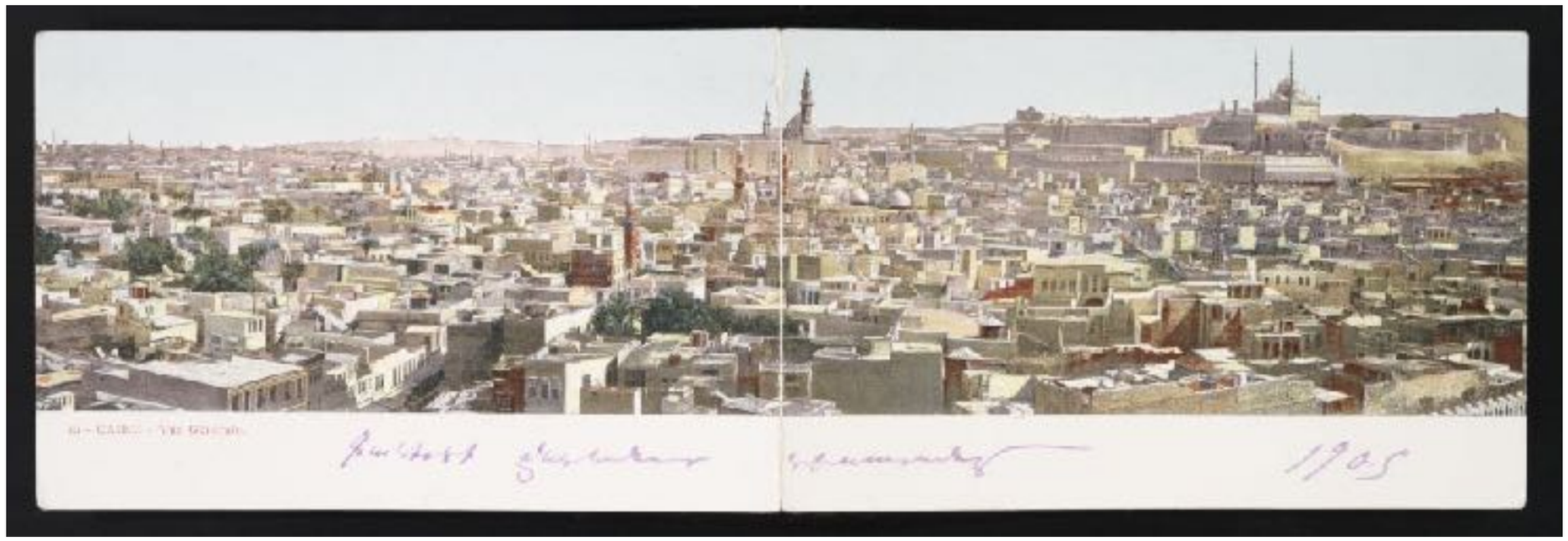
N3

Below: a rather dubious-looking post-card view of some rather new-looking wind-catchers, supposedly on the roof of al-Azhar Mosque. This is not a genuine photograph. Note that the devices are open on both sides, which is incorrect by medieval practice. There are no such devices there now.

Above: two, actually three, real *malqaf*s on the roof of the al-Azhar Mosque. The post-card is signed "L.L.", and has been ascribed to "Léon & Lévy". Auguste Léon visited Cairo in 1914, some 10 years before "Lehnert & Landrock" set up shop in Cairo, but he had a higher goal with "Les Archives de la Planète".

http://digitalcollections.aucegypt.edu/cdm/compoundobject/collection/p15795coll21/id/1849/rec/37

King, *In Synchrony with the Heavens*, vol. 1, VIIb: 784.



A mere half-dozen wind-catchers are still to be seen on this 1905 post-card.

Source: EgyV5_0018r.jpg;
also Travellers in the Middle East Archive (TIMEA), 5623: http://hdl.handle.net/1911/5623.

N5

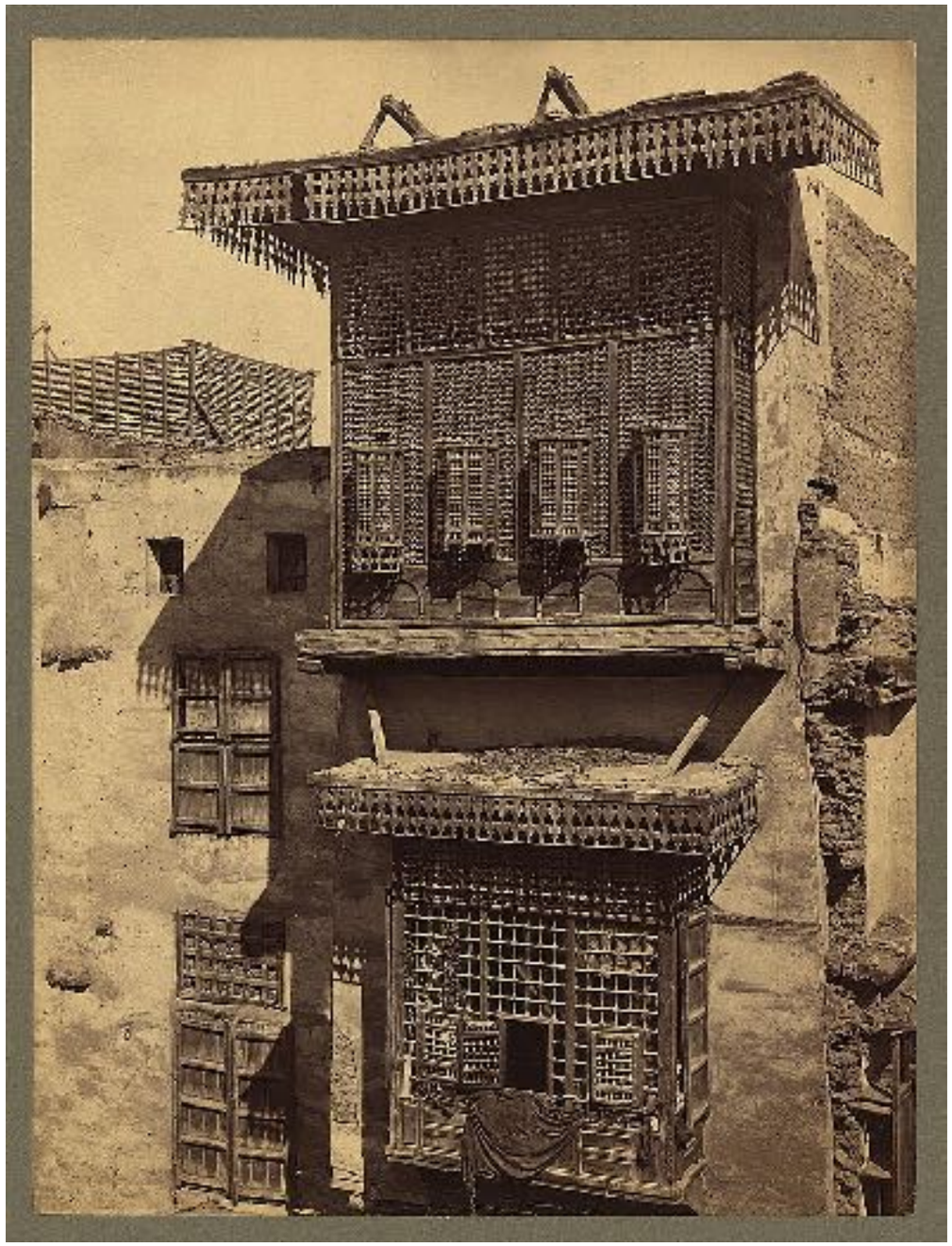
The curious contraption in the middle of the photo is perhaps one of the kinds of wind-catchers (ʿ*ādilī* variety) that are described in the astronomical texts; however, there appears to be no associated aperture in the wall. In any case, no other function seems plausible.

From the Exposition Universelle, Paris, 1889, (Egyptian exhibit), taken from Timothy Mitchell, *Colonising Egypt* (1988).

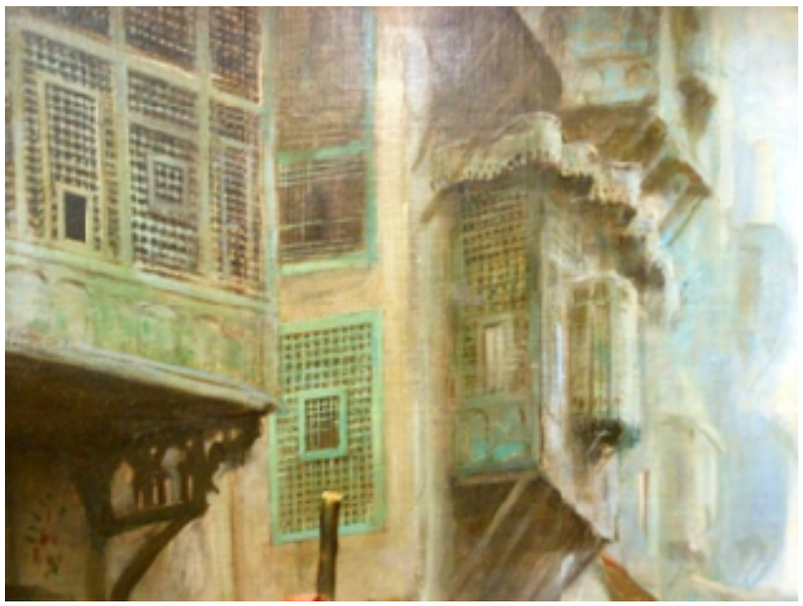
N5a

Various bits and pieces can be seen on the roofs of the buildings lining this "Old Cairo Street" (no. 16 in a post-card series from *ca*. 1900).

N6



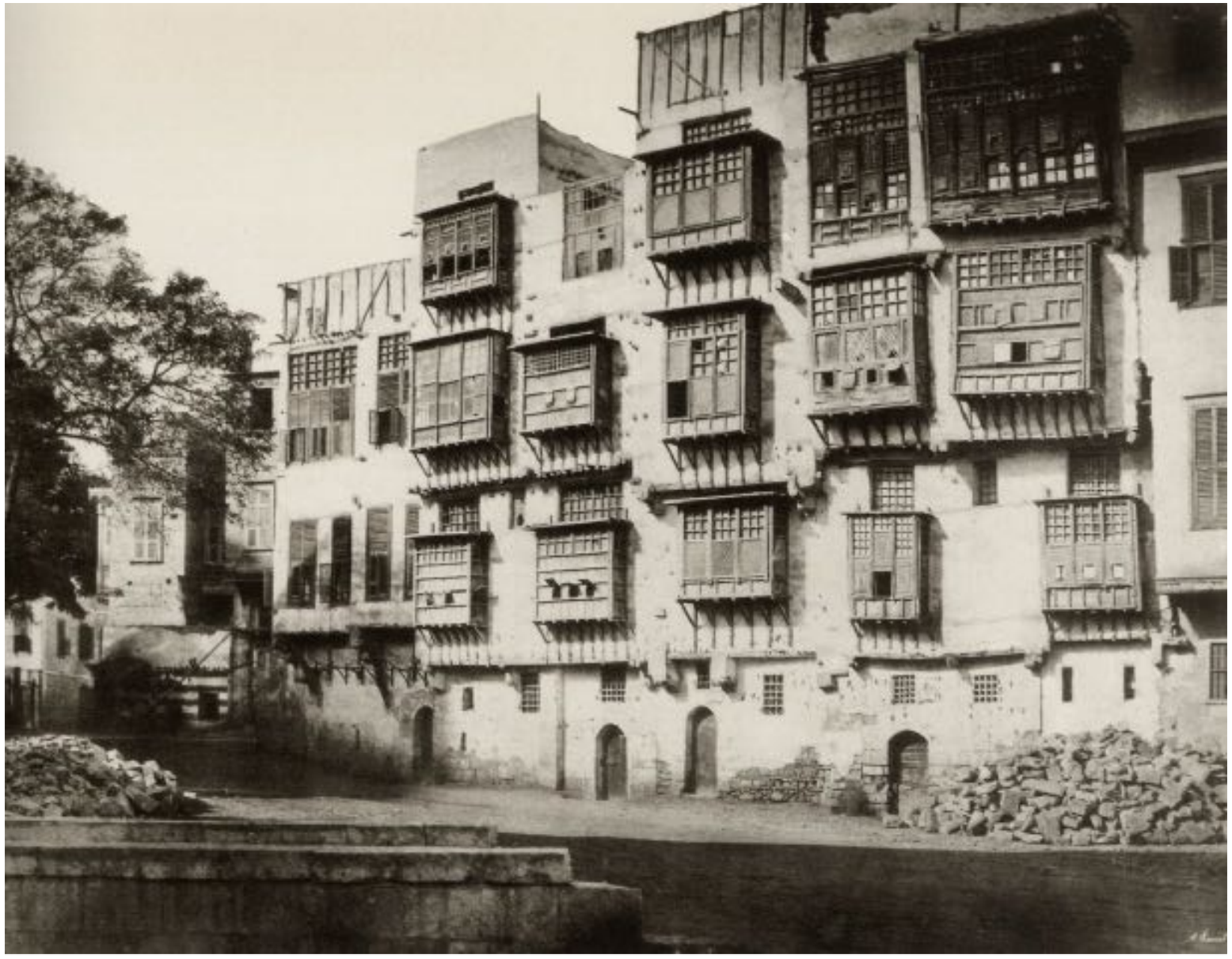
Left: A remarkable image of a pair of *mashrabiyya*s on a 1905 post-card. The *mashrabiyya*s appear to be facing a northerly direction and the photo was taken in summer. On the roof-top on the left we see a fenced enclosure which may have 'taken over' from a *malqaf* (see Pls. N2 & N6a).



A detail from a Cairo street-scene by the Italian painter Fabio Fabbi (1861-1946).

https://m.skinnerinc.com/auctions/2779B/lots/352

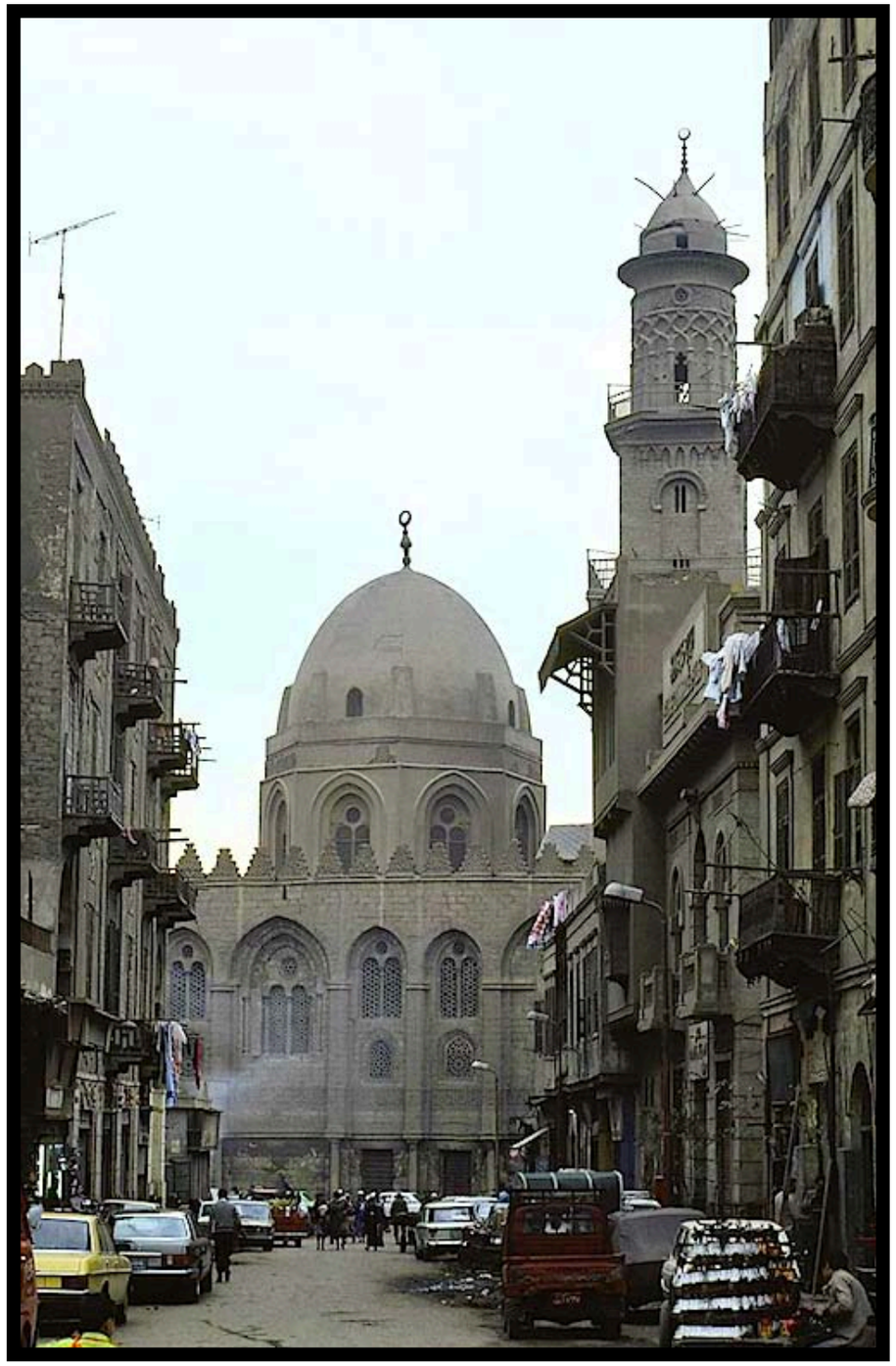
N6a



A spectacular array of *mashrabiyya*s on a housing complex (*rabʿ*) in Cairo captured by the German botanist / photographer Jakob August Lorent *ca*. 1850. There are no wind-catchers visible on the roof, but rather awnings erected with wooden supports to create private recreational space.

www.pinterest.com/pin/140034488272602 42/

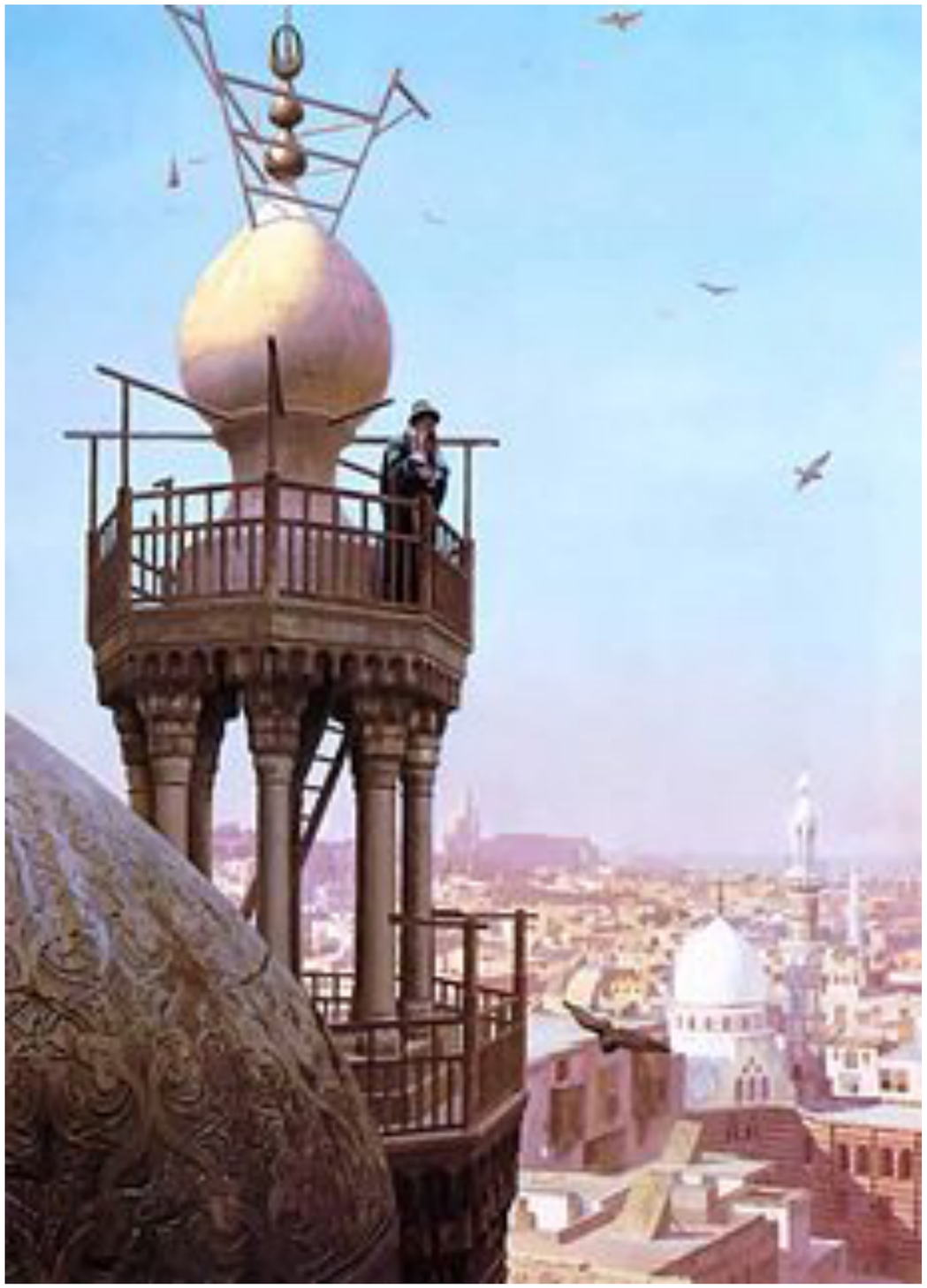
N7



Kathryn Moench, “Built form during the Mamlūk Sultanate” (2015), p. 47.

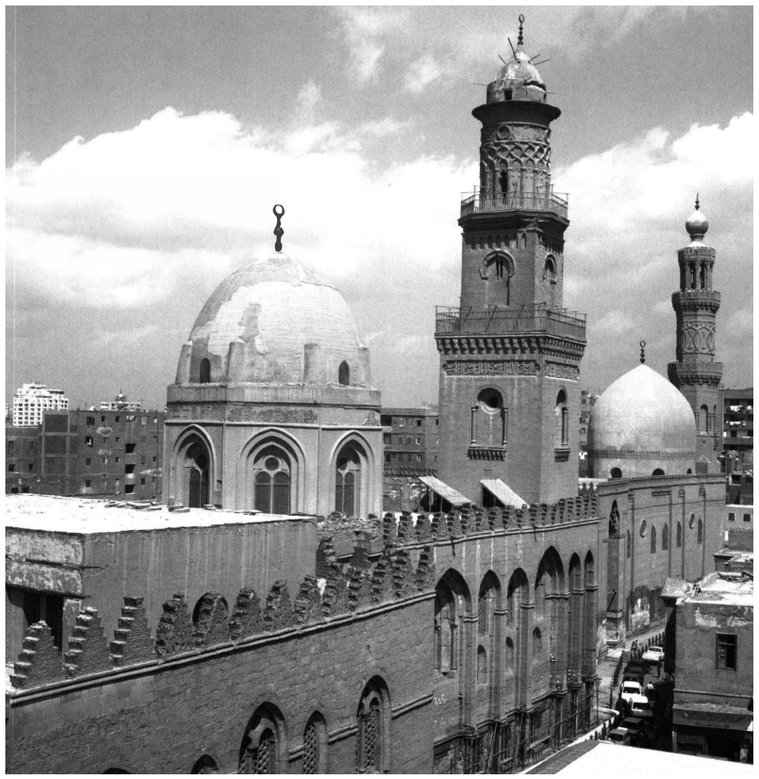
A curious contraption attached to the wall of the upper story of a building adjacent to the Mausoleum of Sultan al-Manṣūr Qalā’ūn (d. 1290). This may be nothing more than a shade over a window. But what is the purpose of the poles sticking out of the top of the minaret?

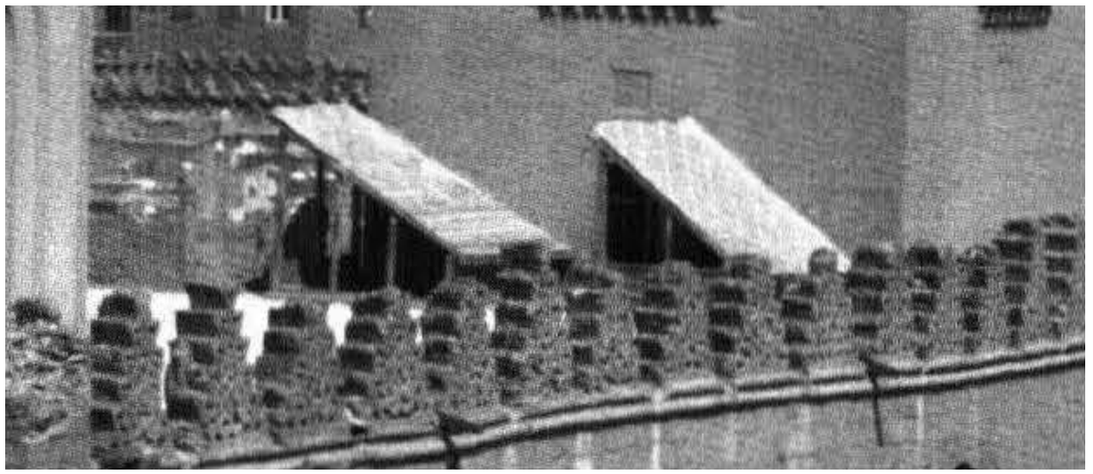
N8



And what is the purpose of the wooden frame on top of the pinnacle of the minaret in Gérôme's painting "Call to Prayer"? Notice also the weight hanging from the frame. I have considered the possibility that the ensemble might serve as some kind of unusual sundial, but any markings on the dome for the hours or for the times of the midday and mid-afternoon prayers would hardly be visible to the muezzin.

N9





The façade of the Qalāwūn complex (1284-85) and the Mosque of Barqūq (1384-86) on the right in a recent photograph. The two devices that look like wind-catchers are of some interest. First, they are facing the wrong direction for wind-catchers: they should be open in the direction parallel to the street away from the camera. Second, if they were turned to face the right direction, the northerly winds would be blocked by the minaret anyway. Third, at least the closer one appears correctly to be open on what should be the western side. Perhaps we are looking at the final resting-place for old *bādahanj*es such as were found on the roof the al-Azhar Mosque. Olivier Jaubert in his inventory of Cairo wind-catchers mentions (no. 21) two vertical shafts close to this minaret and one unsophisticated wooden wind-catcher-like structure (*un auvent de facture sommaire*) on the roof which is supposedly a *manwar* rather than a *malqaf*. These two devices as they are would perform neither function of illuminating or ventilating the space below.

Behrens-Abouseif, *Cairo of the Mamluks* (2007), fig. 78 on p. 132.

N9a

A rather aethereal photo of the roof of the Qalāwūn complex, taken by "Hakim Misr", featured on a website *Hekayt Athr* displaying architectural jewels from the Islamic world. Notice the three sky-lights (*manwar)*, providing illumination in the rooms below.

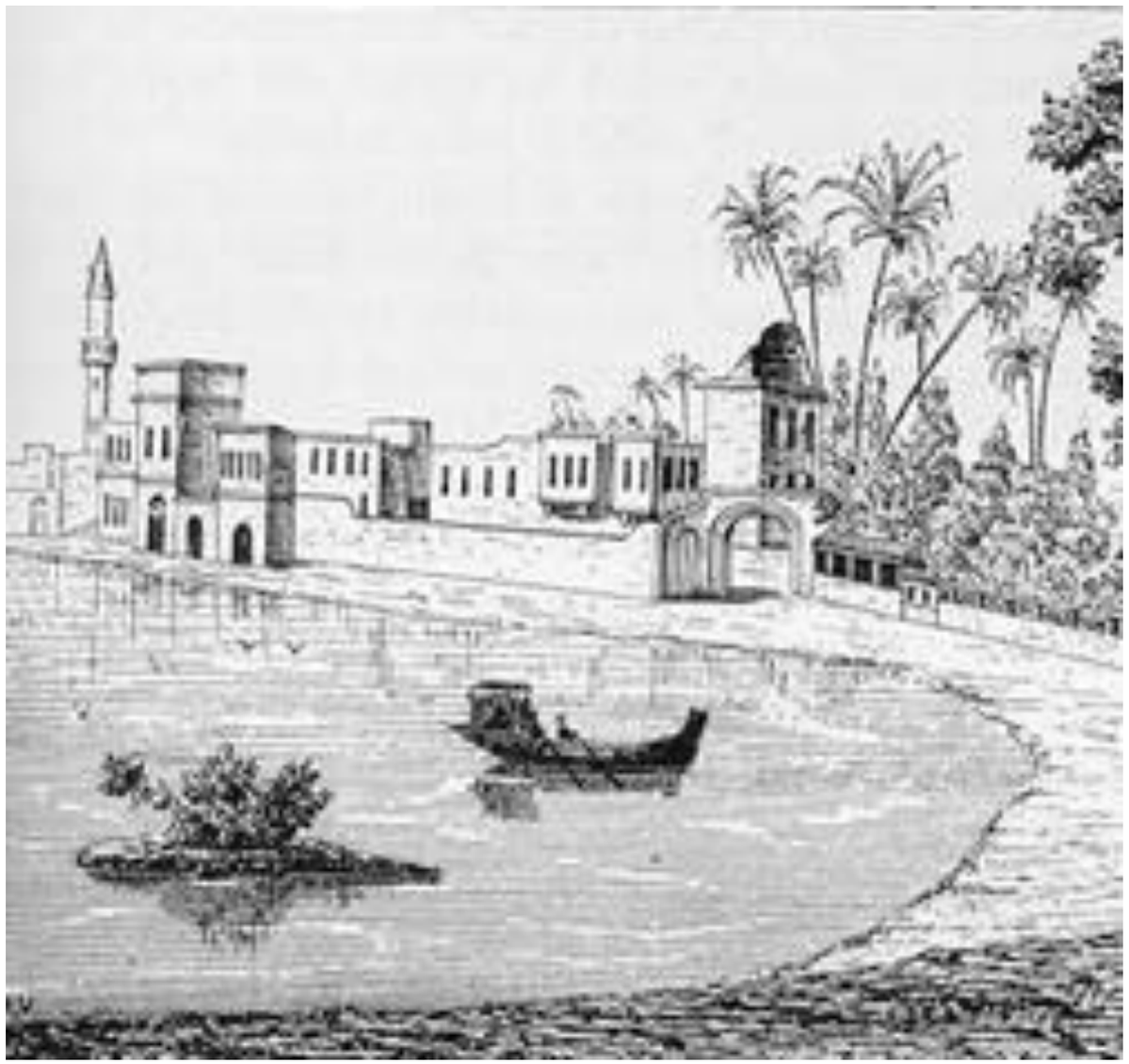
To access the site, google mo.hakimmisr and 524201894713357.

N9b

These vertical cartouche-shaped holes in the side of the dome of the *khānqāh* and mausoleum of Sultan Baybars al-Jāshankir (1306-10, Jaubert #24) were clearly fashioned for a purpose and certainly serve as ventilation-slits. Nevertheless, it is not obvious that whoever pierced the wall had a clear vision of what he was doing. The foundation document (*waqfiyya*) of the edifice indicates that there were originally four serious *bādahanj*es here, of which traces survive.

Photo from 1994 by Olivier Jaubert.

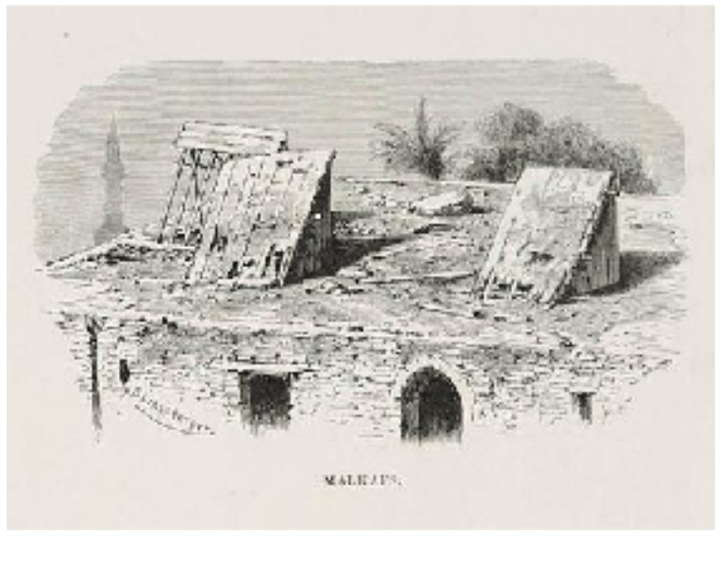
N10



A somewhat idealised but much too modest modern representation of the Palace of Alfī Bey, with a curious tower and 'thing' on the top, but omitting the magnificent wind-catcher shown in the images of the *Description de l'Égypte*. This illustration occurs in a charming article in *al-Ahram* by Fayza Hassan about the delights of historical Cairo.

Fayza Hassan, "How green was this valley" (1998).

N11



Some rather dilapidated wind-catchers in an anonymous sketch turned post-card dated 1878 and bearing the name “Steinberger”. It is questionable whether such a small house clearly of only one storey would have needed three such *malqaf*s. Nevertheless, this is one of only two historical images available which concentrate on the wind-catchers for their own sake (see Pl. E9 for the other). This is the only illustration of an Egyptian *malqaf*s presented in the Arabic Wikipedia article ملقف.

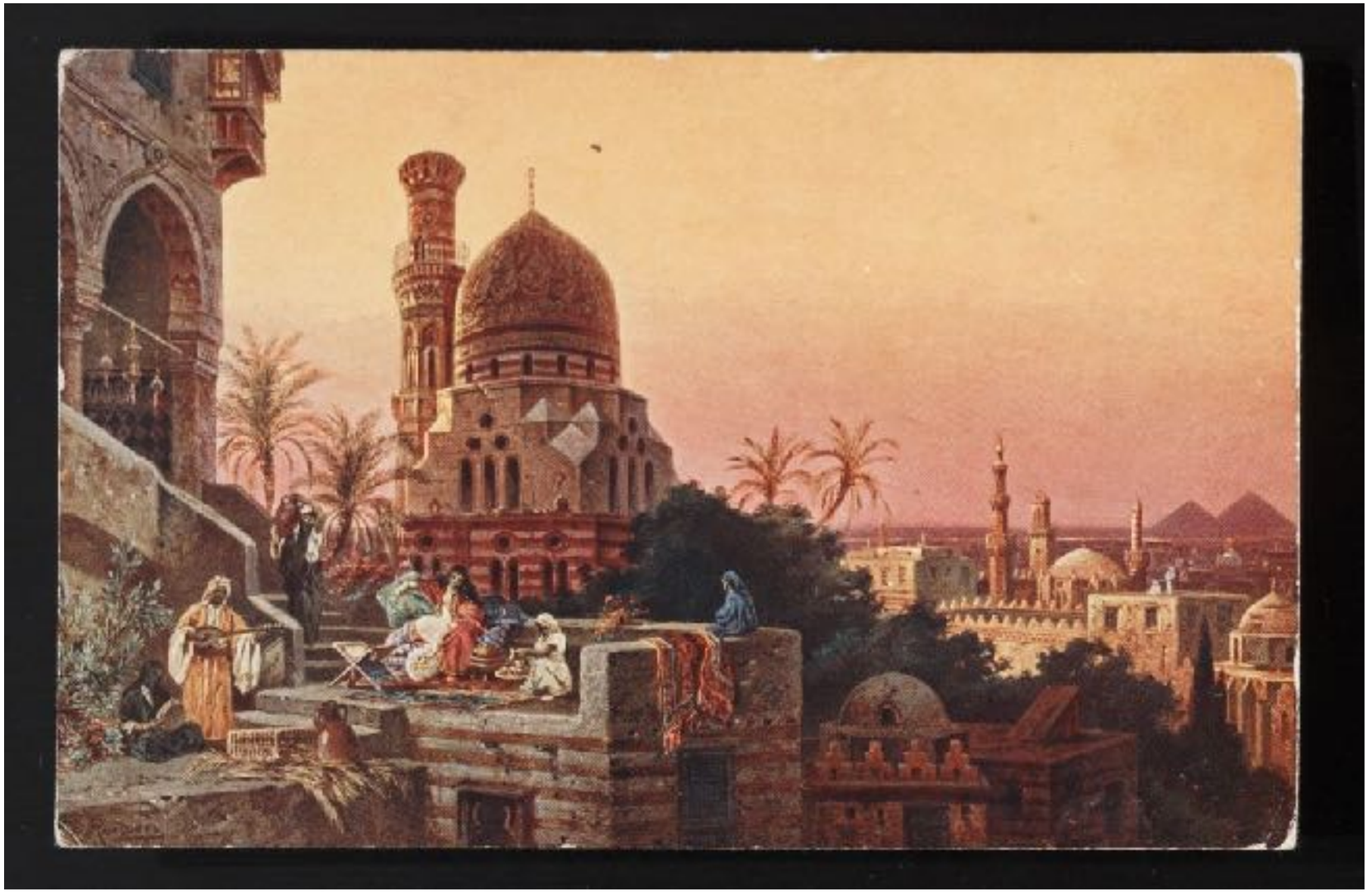
Source: malkafs_(1878)_TIMEA.jpg. See also ar.wikipedia..org/wiki/ملقف.

N12

Somehow this does not look like a scene from Cairo.

294176-ملقف-الهوا.PNG

N13



A stylized postcard view from 1900 showing a woman and child with servants and entertainers on a roof patio overlooking two mosques and with two pyramids in the distance. For good measure, the unknown artist has included a *bādahanj* on a nearby rooftop to the lower right.

Original in collection of Dr Paula Sanders, Rice University, from https://scholarship.rice.edu/handle/1911/5567.

N14

The enigmatic "Flagellation of Christ" by the mathematician-painter Piero della Francesca datable *ca*. 1462. Over 50 different interpretations of the painting were made before we discovered the Latin text, dated 1462, in the form of an acrostic, which inspired the composition of the painting and which enables the identification of all eight persons. (The acrostic was composed by the young man in red for the bearded man, who was his patron. It enables us to reconstruct the scene on the left hand side, so that what it reveals for the right hand side should perhaps be taken seriously.) On the far right there is a bell-tower which no-one would mistake for an Iranian-type wind-tower (*bādgīr*). The struts (Italian *tenditoi*) in front of the windows serve for attaching shades to protect the windows from the sun. In discussing the Latin acrostic and the way in which inspired the composition of the painting, I have suggested that they might serve another function.

Courtesy of the Soprintendenza per il Patrimonio Storico, Artistico ed Etnoantropologico delle Marche, Urbino.

Discussed in King, *Astrolabes and Angels* (2007), esp. pp. 182-183.

N15

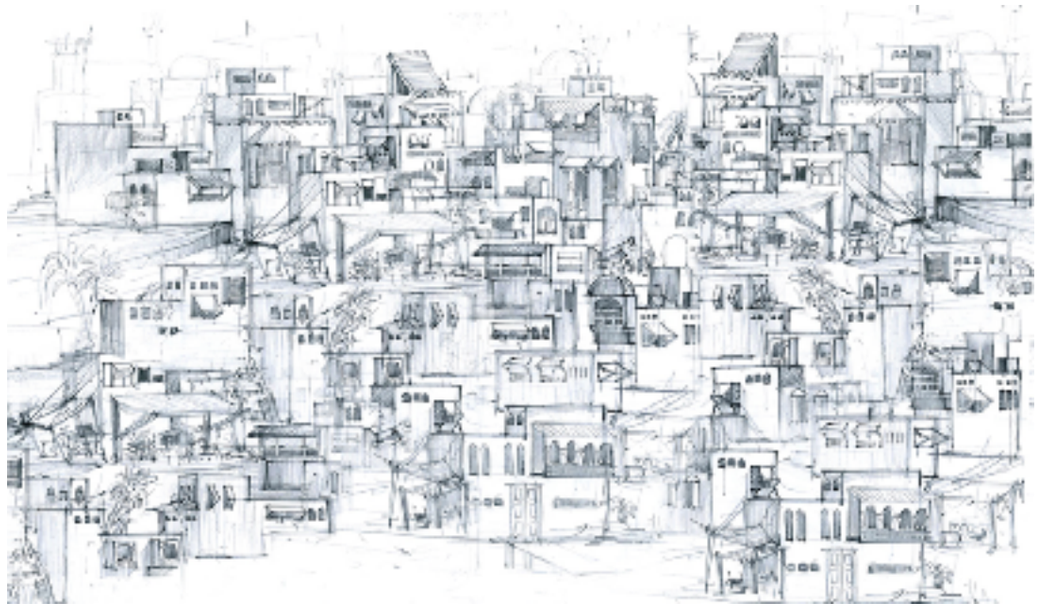
مَلْقَف : مطالع البدور ١/ ٤٥ باب فى الباذهنج . والباذهنج فارسى بمعنى ريح وآهنك . ما يعول عليه ١/ ٢٨٦ باذهنج : الدرك . خزانة ابن حجة ٣٩٨ ، ٤٧٦ وفى ٤٨١ لغز فيه . معاهد التنصيص ٥٨٧ . مستوفى الدواوين ، ظهر ص ٣٠٣ مقاطيع بالأصل والحاشية . الإفادة والاعتبار لعبد اللطيف البغدادى ، آخر ص ٣٨ الباذهنج . ابن بطوطة ١/ ١٨٢ . روض الآداب ٢٨٢ مقطعات فى الباذهنج . وانظر ص ٢١٨ من الكتاب رقم ٦٤٨ شعر ثلاث مقطعات . الطراز المذهب ٧٥ البادهنج ، وانظر رقم ١١ بالحاشية . الشفاء فى بديع الاكتفاء للنواجى ٦٤ للقيراطى فى باذهنج . ديوان ابن سناء الملك ١٢ بيتان فى باذهنج . الحواضر لأبى شامة ، أواخر ٢٨٨ مقطوعان ، وفى أوائل ٢٨٩ ثلاثة مقاطيع فيه . المجموع رقم ٦٥١ أدب ص . . شعر للقيراطى فى باذهنج . ديوان البوصيرى ٨٥ بيت فيه باذهنج . ديوان ابن أبى حجلة ، آخرص فى بادهنج ، وانظر أول ٦٦ و ٩٥ وفى آخر ١٢٣ مقطوعان ، وجاء فيهما بادهنجى ، وفى آخر ١٣٨ و ١٧١و ٢٠٢ . وفى ٢٠٥ وفيه بادهنجى . ما يعول عليه ج ٢ أول ص ٣٨٣ . * راووق النسيم الباذهنج* . شفاء الغليل ١٧ بادهنج ، وفى ١١٠ راووق النسيم .

الموشى ، آخر ص ١٧٩ مستنظر فى شعر ، وأوله فى ١٨٠ ، ويظهر أنه كالملقف أولعله شباك ينظر منه ويجلب الريح .أزاهير الرياض المريعة للبيهقى فى اللغة ٥٠ : آذرباد من أسماء البلاد معناه الريح لان لفظ باد الريح . انظر فلعل الجلى يرادف الملقف .

An extract from the dictionary of colloquial Egyptian Arabic by the renowned Egyptian scholar Aḥmad Taymūr (1871-1930) dealing with the word ملقف , *malqaf*, for wind-catcher. The author presents a whole page of references to the term بادهنج , *bādahanj*, in the literature known to him. Many of the references are to the two 14th-C anthologies of poetry which deal with the *bādahanj*. Most of the rest, but not all, have been exploited in Part I in order to document the history of the device in Egyptian architecture.

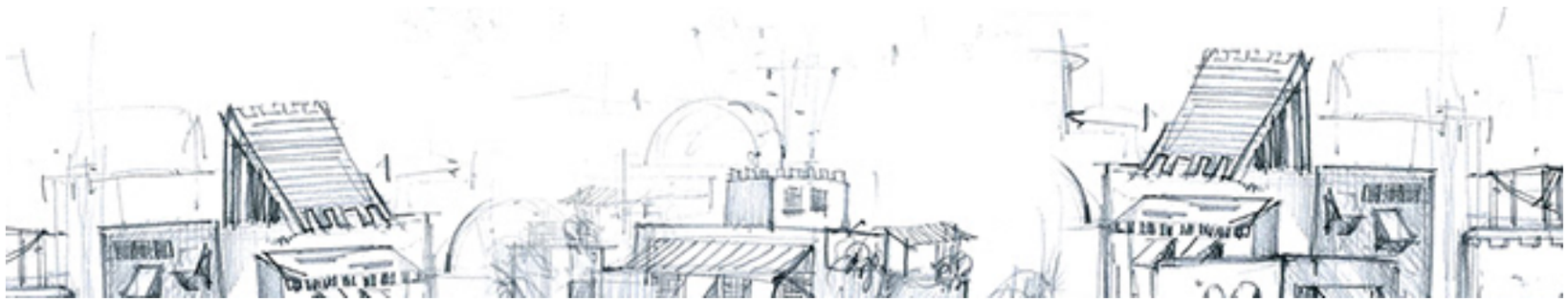
Aḥmad Taymūr, *al-Muʿjam al-kabīr* (2002 edn.), V, p. 393. I owe this reference to the kindness of Alev Masarwa. (Received in December, 2019, when this monograph was completed.)

N16



www.behance.net/gallery/91975685/Old-Cairo-Harbour

A painting presenting a fanciful rendering of "Old Cairo Harbour" and a sketch showing a hillside of houses, both by the Egyptian artist Noura Dalam. Both are remarkable not only because they display *malqaf*s. The painting shows a single such device, and the sketch shows two on the crest of the hill. The one at left would be non-functional because the wind would tend to dissipate through the holes at the bottom of the cover, rather than be forced inside the house, but this an imaginative painting, not a diagram in a engineering manual.
Noura Dalam deserves much credit for realising that wind-catchers belong here.



Please note: The images from the 19th and 20th centuries presented above do not in themselves constitute proof that the wind-catchers were present in Cairo in previous centuries. The evidence that they were omnipresent in Cairo from the 10th century onwards is provided by Egyptian astronomical texts from the 10th to the 17th century, by Egyptian poetry from the 11th to the 14th century, and by Muslim and European travellers' accounts. For details see Part I.

P: Ventilation in Baghdad & Aleppo & Palermo

Although *bādahanj*es are very occasionally mentioned in early medieval texts dealing with Baghdad, Aleppo and Damascus, there seem to be fewer architectural traces than what we find in Cairo.

P1

The skyline of Baghdad

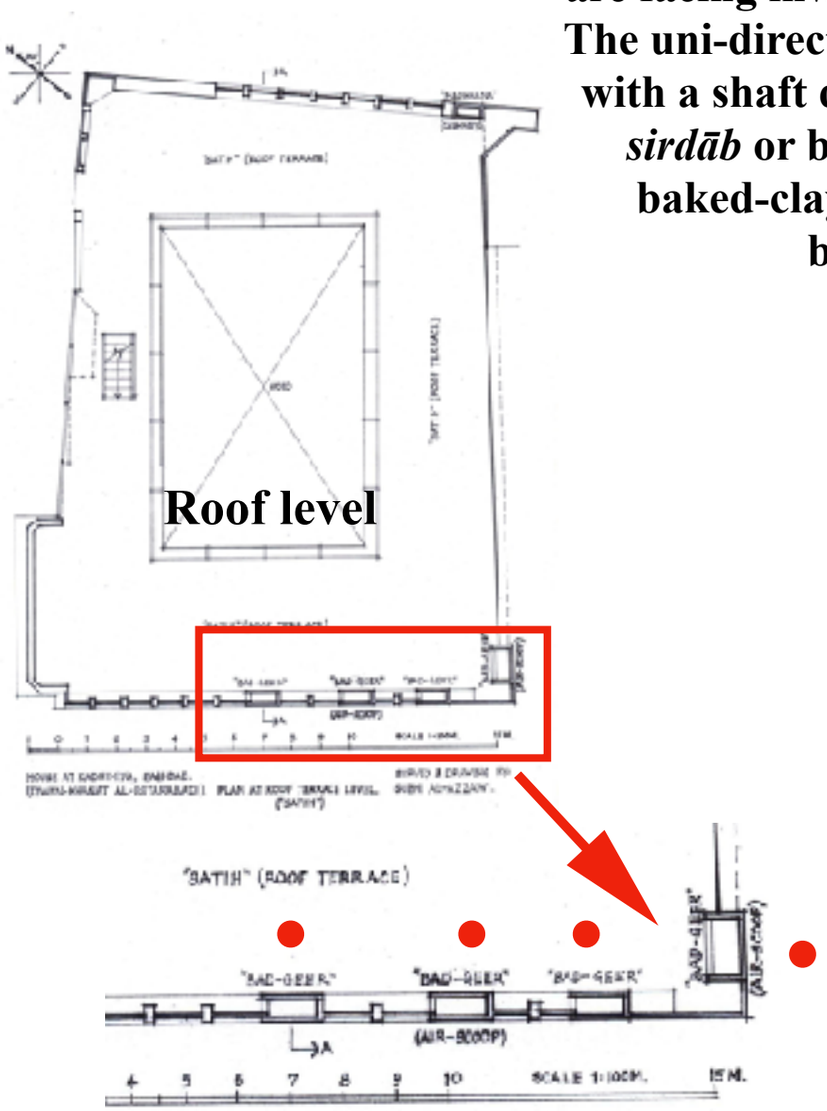
We have written sources which indicate that there were *bādahanj*es in Baghdad in the 10th C. These modern impressions of monumental and domestic architecture give the impression that *bādahanj*es are/were not part of the scene. However, some of them were actually built with the air-shafts, rectangular in shape, inside the walls – see Pl. P2-3.

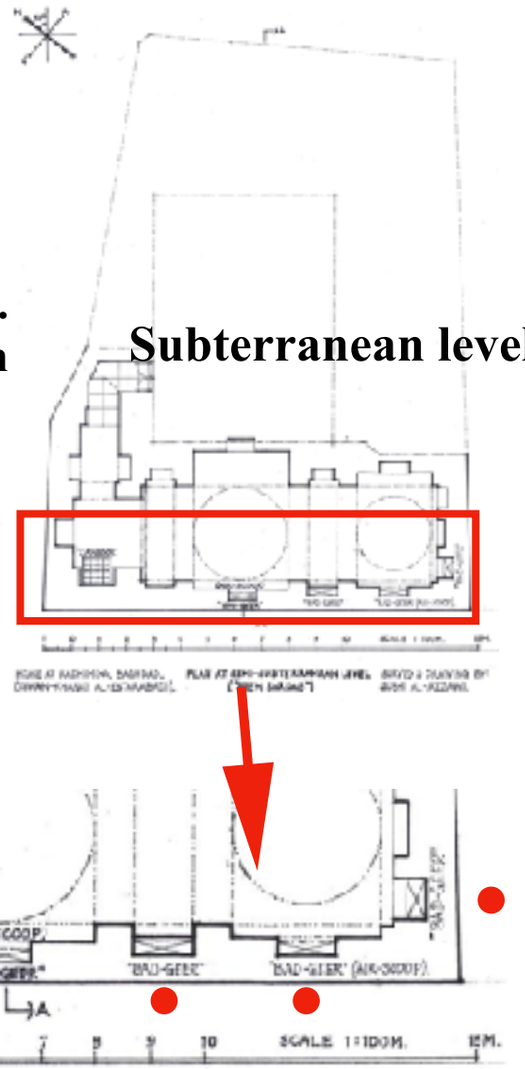
www.worldbulletin.net/place/baghdad-eye-witness-accounts-throughout-the-ages-h136203.html
https://stock.adobe.com/de/images/old-baghdad-on-iraqi-100-dinar-2002-banknote-closeup-iraq-money-close-up/221035126

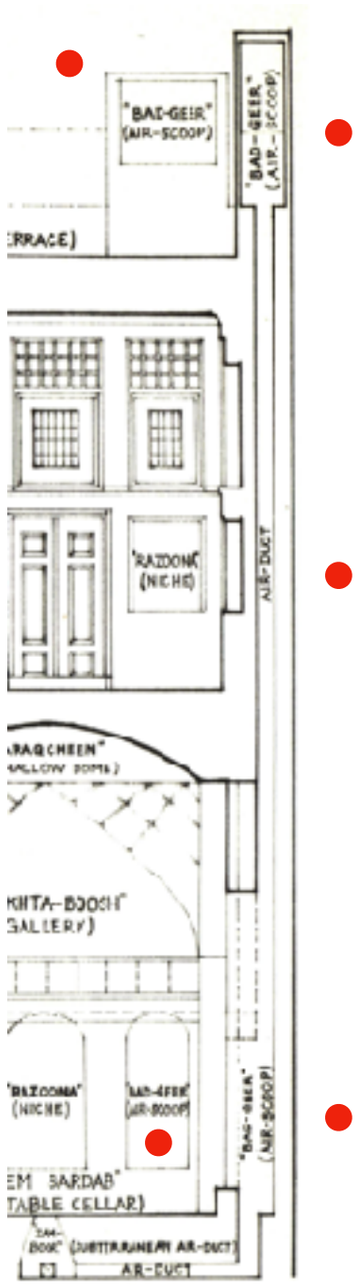
P2

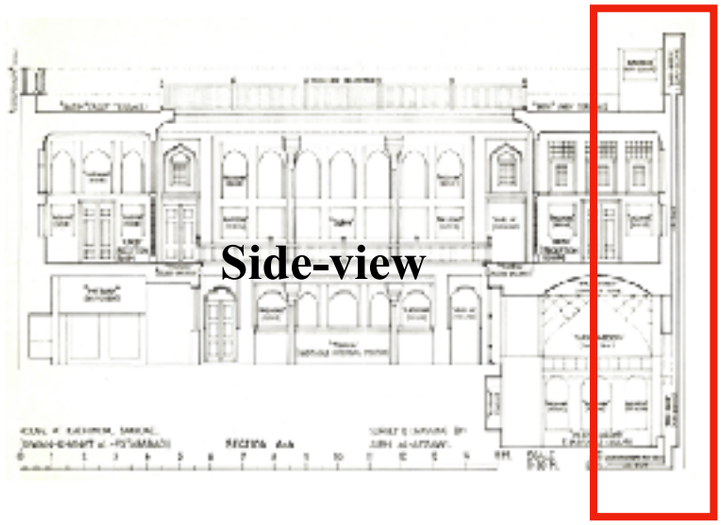
Iraqi architect Dr. Subhi Al-Azzawi has documented the *bādgīr*s in the Dīwān-Khānāt al-Asterābādī, *ca*. 1840-1850, in the region of Baghdad known as al-Kāẓimiyya. It is safe to assume that this kind of device goes back centuries.

Here three *bādgīr*s face the NE wind and a larger one faces NW wind (the scoops are facing inwards rather than outwards). The uni-directional wind-catcher is shown with a shaft descending as far as the *nīm sirdāb* or basement. There is a large baked-clay jug (*zīr*) of water at the base of the shaft.







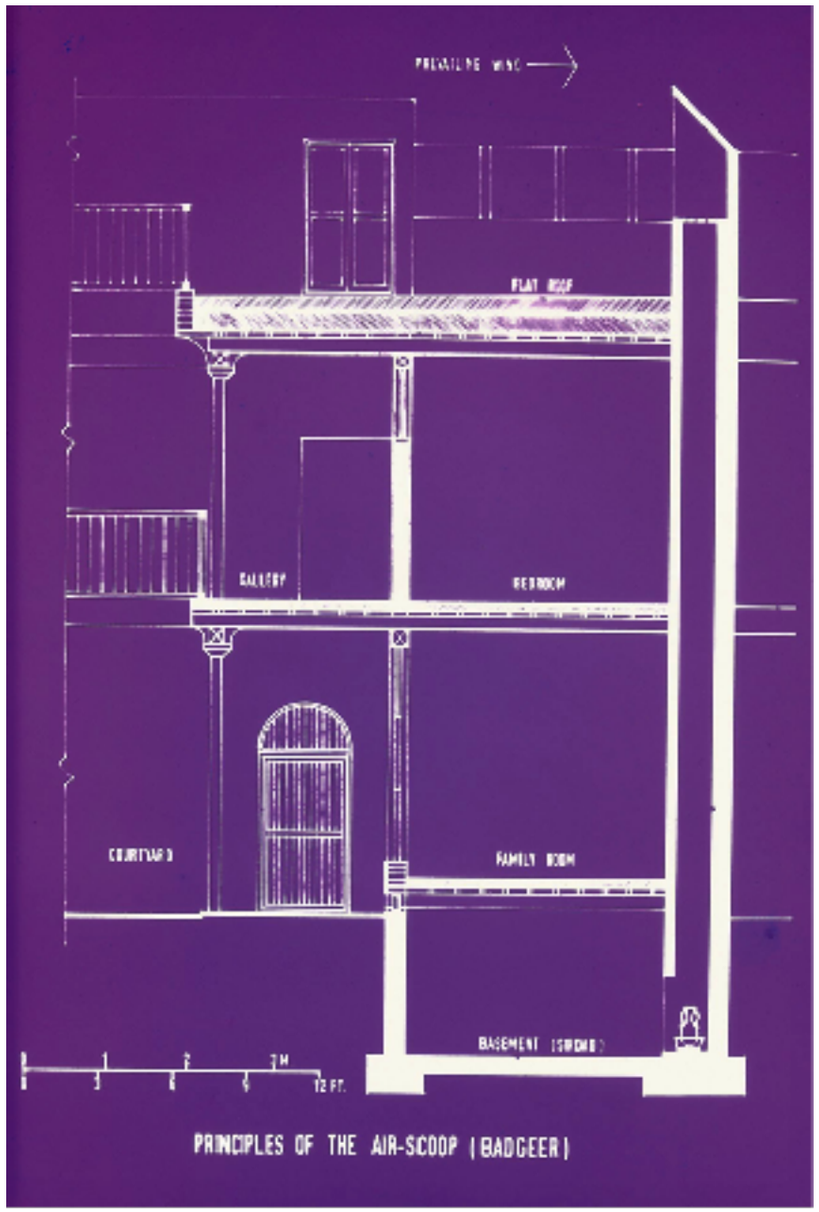


(Plans courtesy of Dr. Subhi Al-Azzawi.)

Dr. Subhi Al-Azzawi has likewise documented the *bādgīr* in his family home in Baghdad, dating from *ca*. 1920. Here the uni-directional wind-catcher is shown with a shaft descending as far as the *nīm sirdāb* or basement. There is a large jug (*zīr*) of water at the base of the shaft.

Such devices go back at least a millennium.

In Part I we present documented textual evidence from 10th-C Baghdad showing that a *bādahanj* large enough for a man to sleep inside it overnight is attested in a story about the Caliph's harem. Three other 10th-C ʿIrāqī sources mention such devices.



(Plan courtesy of Dr. Subhi Al-Azzawi.)

P3a

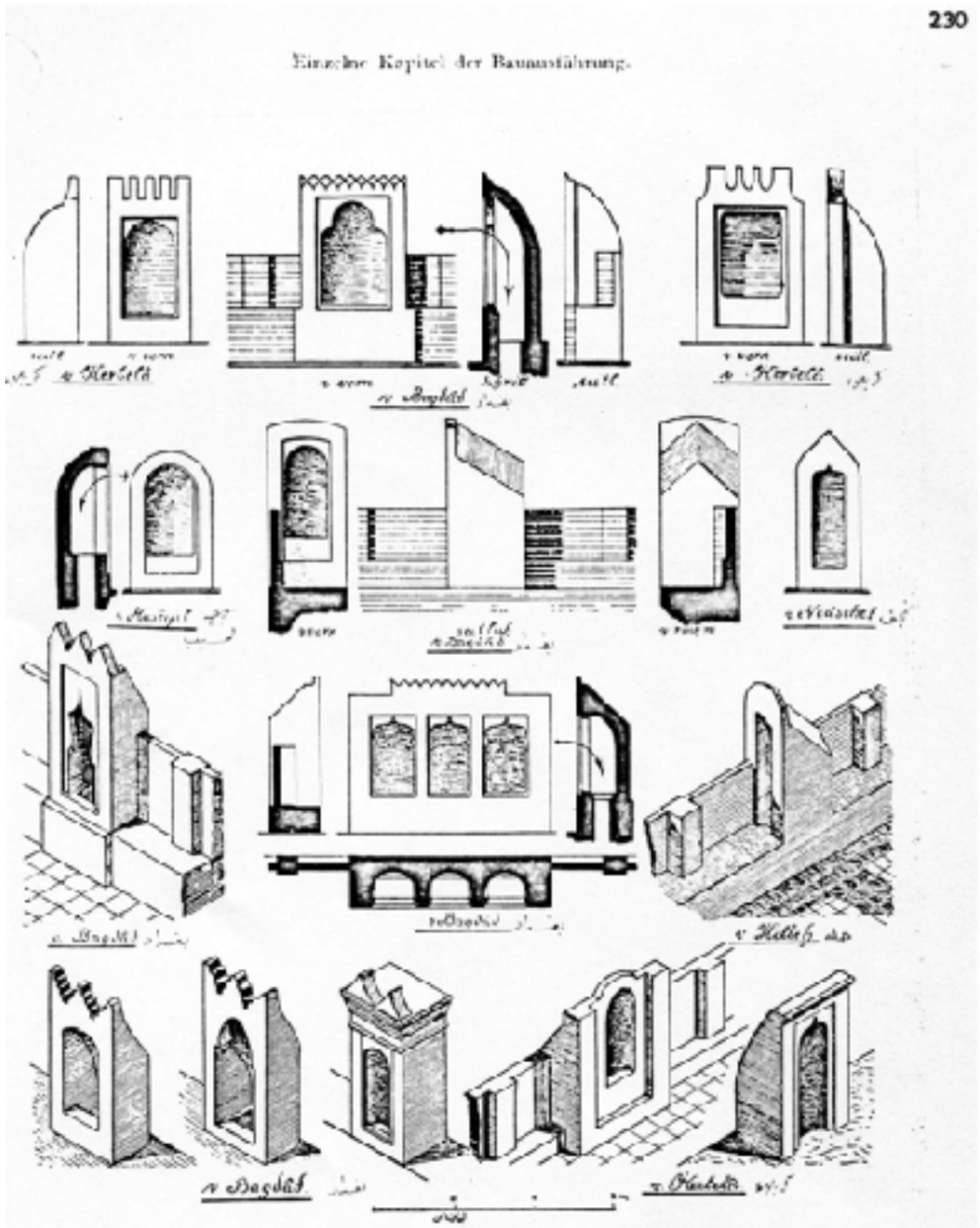


Fig. I.55. Plan, sections, elevations and axonometric drawings of various types of inlet openings to air-scoops ("Bad-Geerat") at roof terrace level ("Satih").
(Source: F. Langenegger, op. cit., fig. 220, p. 180).

Sketches in Felix Langenegger's 1911 doctoral dissertation on architecture in Iraq showing examples of *bādgīr*s in different cities across the country (Baghdad, Kerbela, Najaf, Hilla).

Langenegger, *Beiträge zur Kenntnis der Baukunst des Irak* (1911), esp. p. 180, also in Azzawi, *Traditional courtyard houses in Baghdad* (1984), p. 230. Image courtesy of Dr. Subhi Azzawi.

P3b

This painting in a manuscript of the famous *Maqāmāt* of al-Ḥarīrī of Basra (d. 1121/22) shows an architectural above the two men sitting on the daïs on the left-hand side. This has been interpreted as a *bādahanj*, but it appears to be be nothing more than a skylight, of the kind known in Cairo as *shakhshūkha*. – see Pl. Q5a.)

MS Paris Bibliothèque nationale de France ar. 5847, fol. 148v, copied 1237, from Gehan S. A. Ibrahim, *Virtues in Muslim Culture: An interpretation from Islamic literature, art, and architecture* (2014), from taken from an internet site that is no longer active.

P4

The skyline of Aleppo (I)

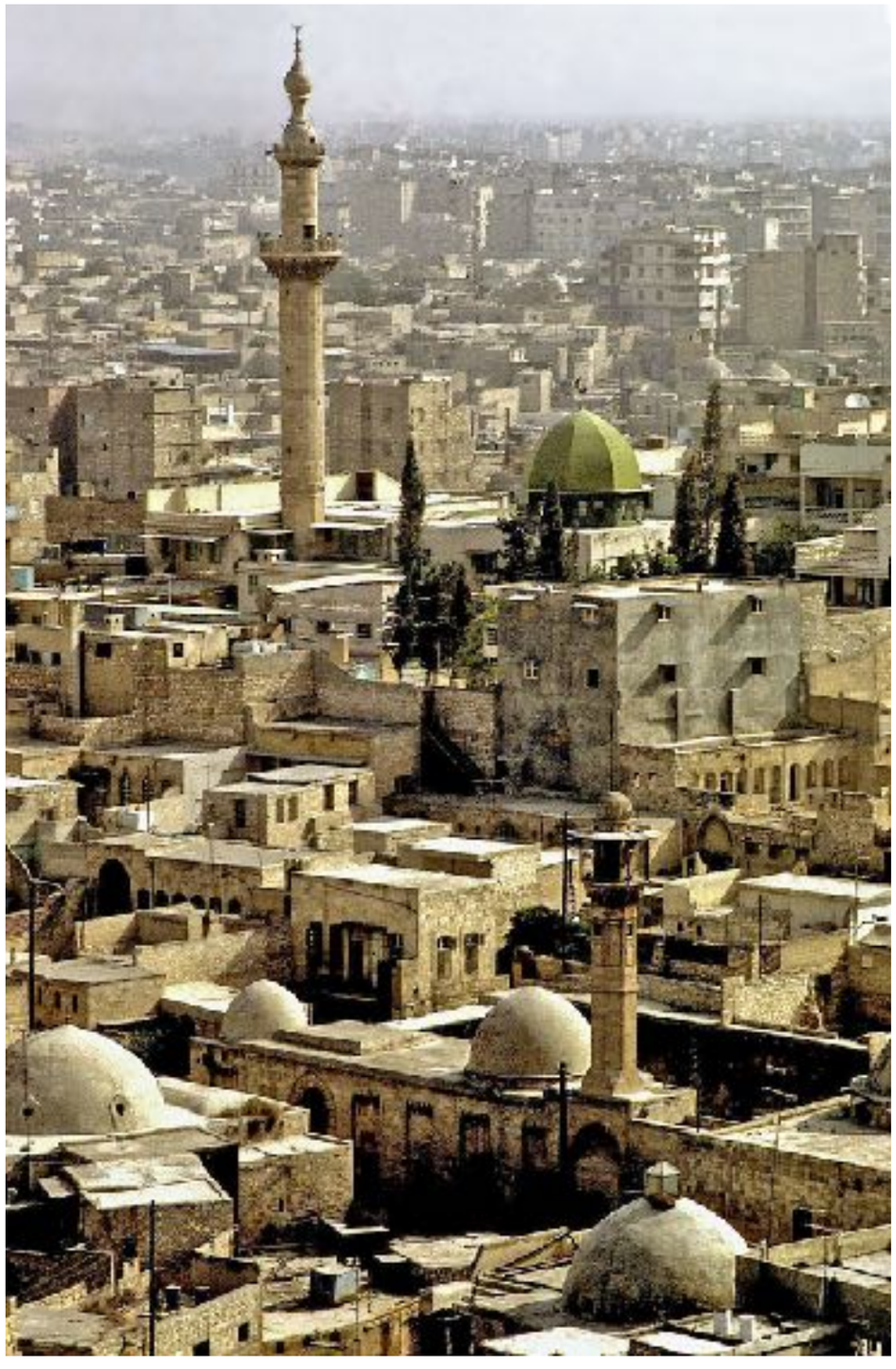
“Veüe de la ville d’Alep et de son château” by Étienne Gravier, marquis d’Ortières, 1686

Henry Maundrell, 1703

One should not expect to see such items as wind-catchers represented on images like these. Yet we have a reliable 11th-C source, the Christian medic Ibn Buṭlān, who wrote that each house in Aleppo had several wind-catchers. He also visited Cairo, where just over a hundred years later a prominent Persian scholar recorded that in that city there was hardly a house that did not have such a device.

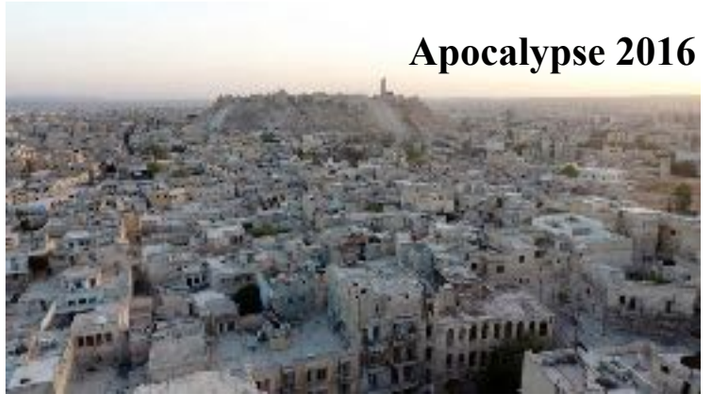
https://i.pinimg.com/originals/91/27/3f/91273fe3b791436b8acddacbcc67306b.jpg
www.bureaualisaad.eu/Aleppo-City-Vision

The skyline of Aleppo (II)



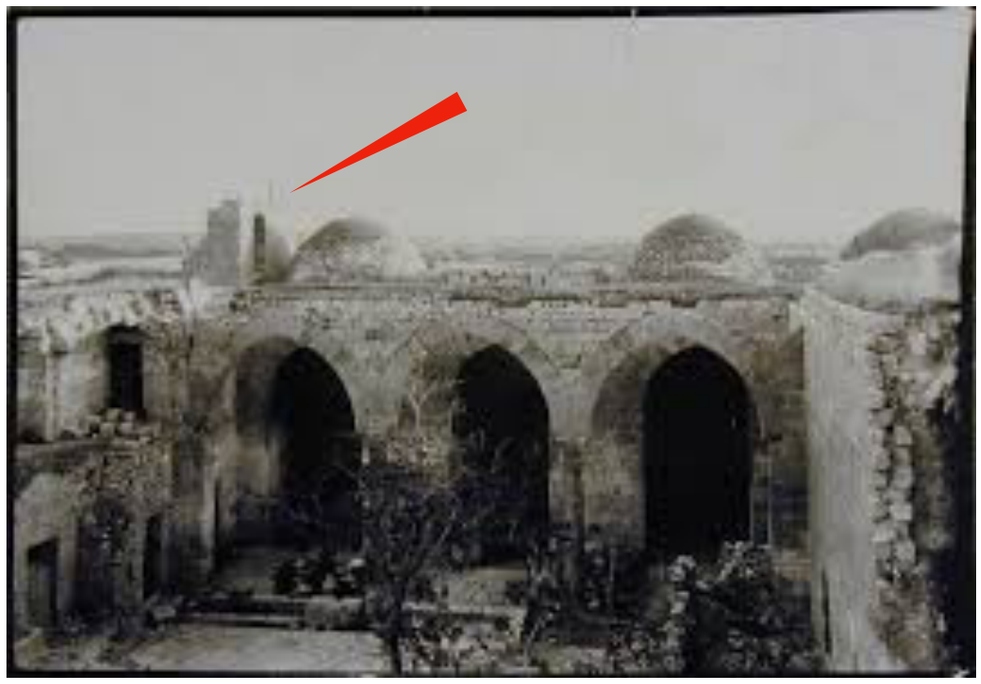
1930s guide: "Aleppo -
The ancient and populous capital of Northern Syria –
The town of perpetual Oriental miracle –
On the way to Egypt and Palestine"

Apocalypse 2016



www.maggs.com/alep-et-ses-environs_232409.htm
www.meisterdrucke.at/kunstdrucke/French-School/465594/—Plakatwerbung-für-das-Baron-Hotel-in-Aleppo,-um-1920.html
www.srf.ch/news/international/vorher-nachher-wie-aleppo-zur-hoelle-wurde
http://fr.trekearth.com/gallery/Middle_East/Syria/photo1529247.htm

P6



On the roof of the Ẓāhiriyya Madrasa in Aleppo, dating from 1213/14, there is a feature that has been thought to be wind-catcher. It was labelled a *malqaf* already by K. A. C. Creswell 70 years ago. The aperture looks like a doorway but there is no doorstep. During restoration a second such opening nearby has been reinstated. The two openings do in fact lead to ducts which descend to apertures on either side of a *miḥrāb* or prayer-niche. The openings are partly blocked by the dome in front of them which will surely deflect some of the wind. The view on the left is toward the south, that is, roughly towards the *qibla* for Aleppo.* This means that the *malqaf*s are open toward the west, but easterly winds, predominate only in winter and are bitterly cold at that. It also means that the *miḥrāb* beneath the two would-be *malqaf*s will be facing perpendicular to the *qibla*. The existence of these features raises questions that cannot yet be answered and their positioning and orientation raises even more questions.

https://archnet.org/sites/1826/media_contents/35808

*** The *qibla* in Aleppo in Mamluk texts is about 18° E of S.**

P7

A view of Damascus in 1677 by the Dutch geographer and physician Olfert Dapper (1636-1689), who apparently never left his native Amsterdam. The 10th-C geographer al-Muqaddisī, from Jerusalem, reported the Egyptians had *bādahanj*es "like the people from Syria". Future researchers may be able to find more evidence of *bādahanj*es in historic Damascus, which need not have looked like those in Cairo.

https://de.wikipedia.org/wiki/Datei:Olfert_dapper_1677_damaskus.jpg.

P8

An unsigned European painting in the Musée du Louvre. It has been claimed that the curious structures in the upper left of this scene from what is supposedly Damascus has something to do with a *bādahanj*. This is not the case. It is a veranda surrounded by a guard-rail. Some scholars have maintained that this is a scene from Cairo, but in that case one might have expected a real *bādahanj*.

Jean Sauvaget, "Ancienne representation de Damas au Louvre" (1945/46), where the structures are not mentioned.

Detail of a mosaic in the dome of the mausoleum of Sultan al-Ẓāhir Baybars in Damascus, dating from 1281. The sloping roof halfway up the central tower has been identified as a *bādahanj*, which seems unlikely.

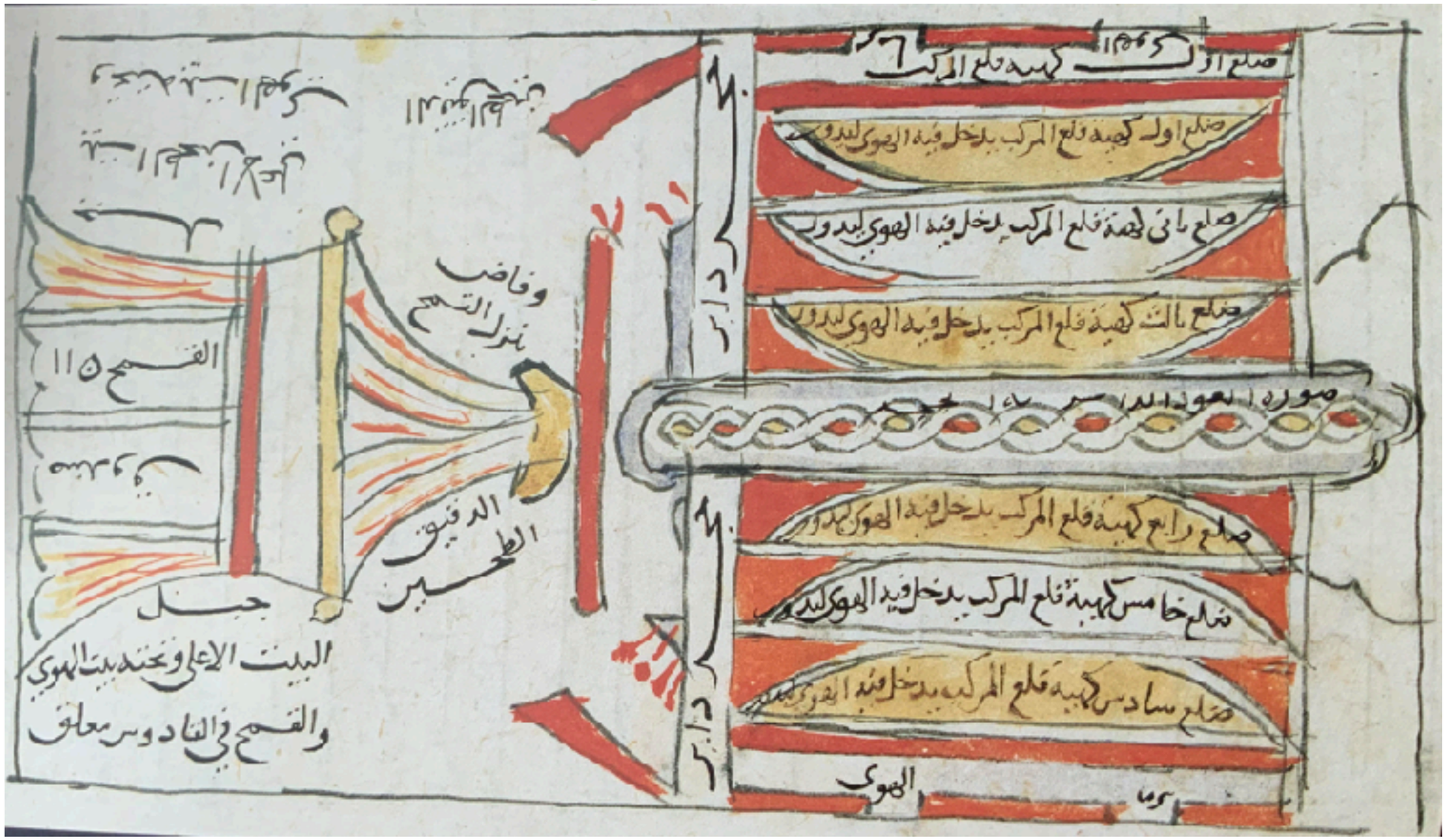
Nasser Rabbat, *Mamluk History through Architecture* (2010), p. 50.

grind-stone vertical wind-vanes

P9

base

vertical axis



grind-stone vertical wind-vanes

Illustration of the cross-section of a windmill with vertical vanes rotating about a vertical shaft, from a treatise by Shams al-Dīn al-Dimashqī (d. 1327) which "contains a good deal of information not to be found elsewhere" (D. M. Dunlop). Alas, no such illustration of a Cairo wind-catcher is known from the medieval sources.

Salim al-Hassani, ed., *1001 inventions – The enduring legacy of Muslim civilisation* (2012), p. 131, from a 14th-century manuscript preserved in the Bibliothèque nationale de France (ar. 2187/5858).

P10

On the left, one of two wind-towers in the in the 12th-century Zisa Palace in Palermo. To the right the hole that is to be found at the bottom of the air-shaft. The inspiration and design of this building is supposedly Islamic throughout. Later Crusader-castles in Syria are thought to have had similar devices for cooling. No study has been made of all the available evidence. (Holes similar to the one shown here were originally found above each of the windows of a former *manhanariá / magnanerie* in the author's home.)

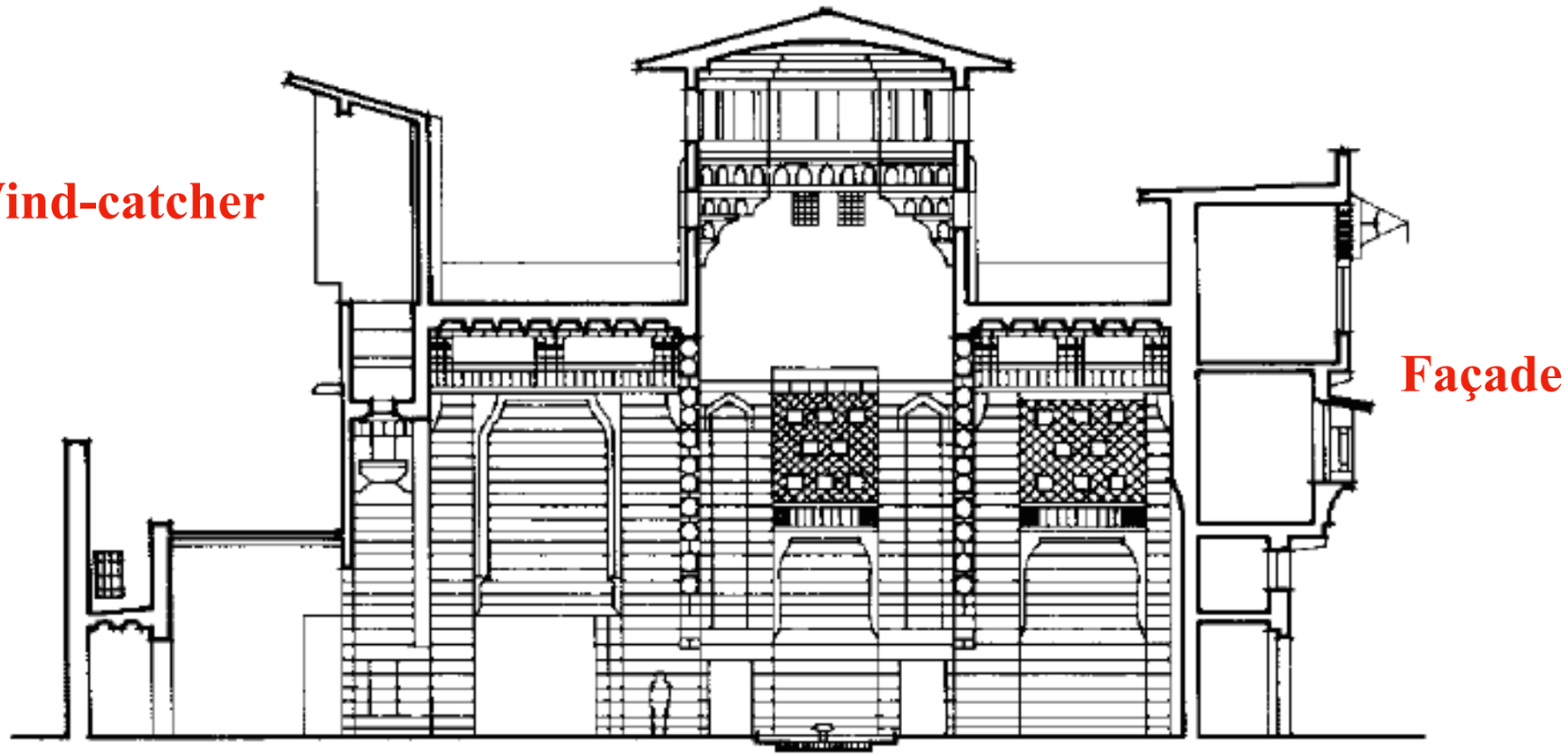
Laurini & Di Vita & De Berardinis & Friedman,
"Passive ventilation for indoor comfort: a historical building in a temperate climate" (2018).

Q: Some surviving *bādahanj*es in Cairo

“I came to him on a hot summer day,
And he gave me a frosty welcome.
I said: “I do not have a *bādahanj* in my house,
But the face of that fellow is my *bādahanj*.””

The poet Ibn al-Ṭūbī, writing in Cairo in the first half of the 11th C.

Q1



Section through the *Qāʿa* (reception hall) of Muḥibb al-Dīn al-Shāfiʿī al-Muwaqqiʿ, built in Cairo about 1350 (Jaubert #27). The *bādahanj* is on the left. Most photos show only the decorated façade on the right. See the next images for some exceptions.

Original source unknown.

Q2

"The Architecture of the traditional Arab house", at https://learning.knoji.com.

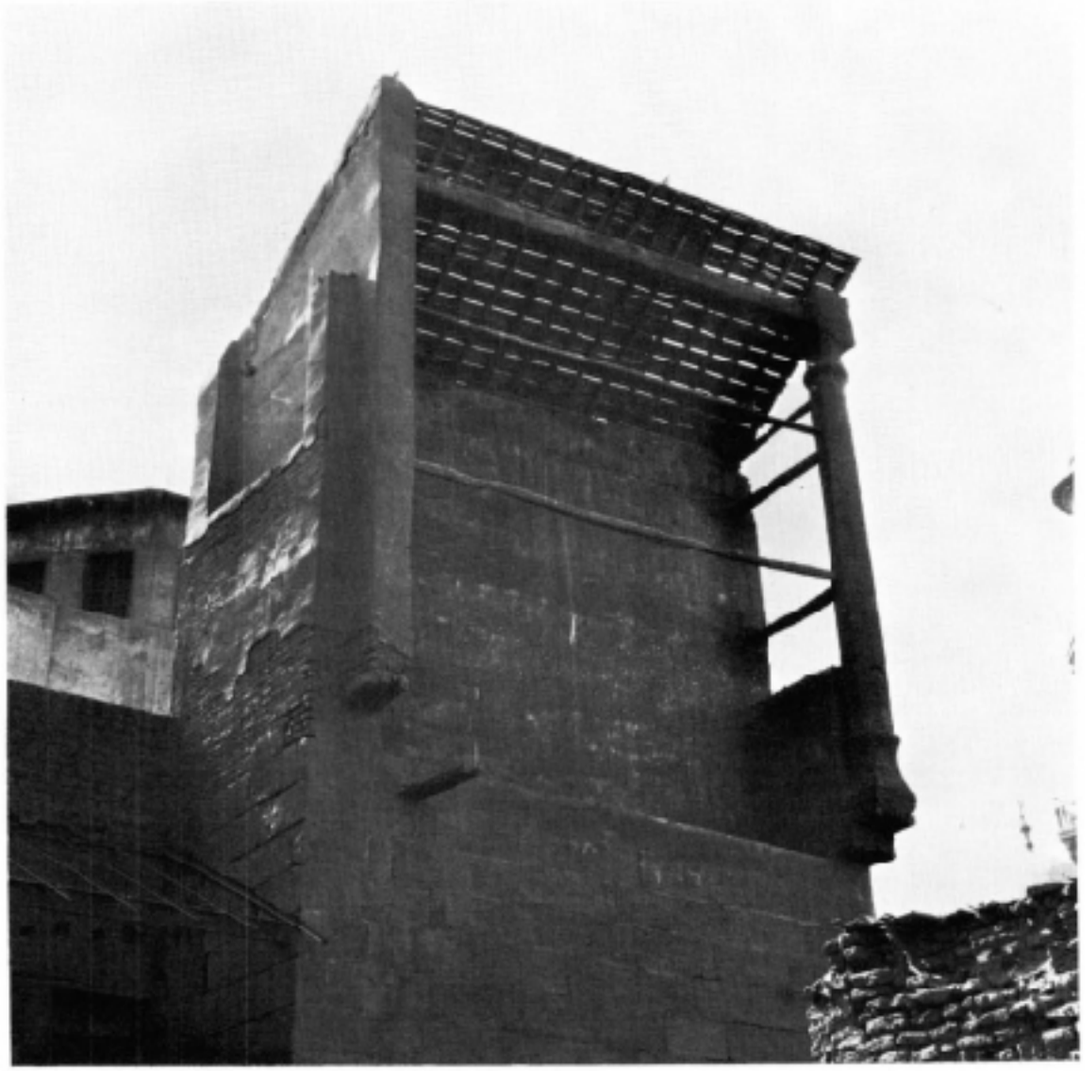
A rare photo of the complex of the *Qāʿa* (reception hall) of Muḥibb al-Dīn al-Shãfiʿī al-Muwaqqiʿ, with part of a rather scruffy-looking *bādahanj* just visible on the left.

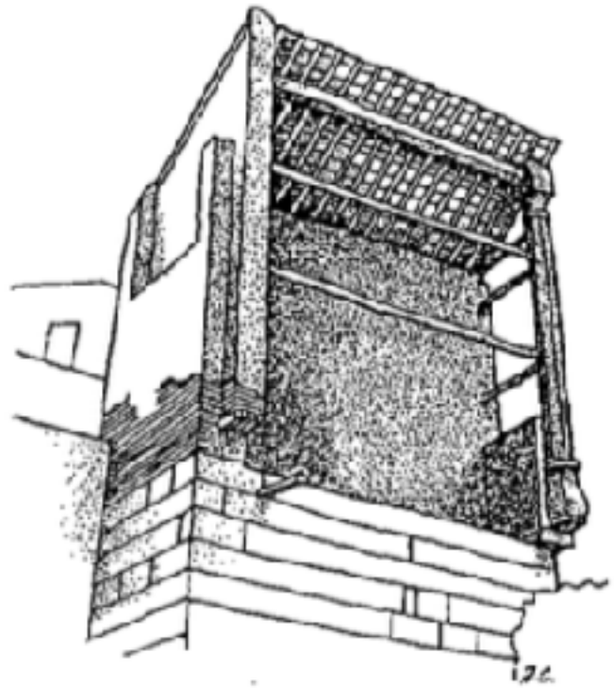
Bahadori & Dehghani-sanij, *Wind Towers – Architecture, climate and sustainability* (2014), p. 94.

Two more rare photos of the entire complex.

Originally from James Steele, *An Architecture for People: The Complete Works of Hassan Fathy* (1997).

Q3





Sketch from Čejka, *Das arabische Haus*, taken from Ragette, *Traditional domestic architecture of the Arab region* (2012), p. 88.

Not a pretty sight, but a very rare one! This is apparently the only photo available of the wind-catcher on the *Qāʿa* of Muḥibb al-Dīn al-Muwaqqiʿ. This is the earliest surviving Cairo *bādahanj* and it is made mainly of stone, not wood! The western side – on the right here – is open to the winds, as it should be, according to medieval astronomical texts. The roof appears to be made of trellised wood, possibly originally covered with wattle.

Garcin & Maury & Revault & Zakariya, *Palais et maisons du Caire*, I: *Époque mamelouke (XIII^e^-XVI^e^ siècles)* (1982), pl. 60.

Q3a

The *bādahanj* on the roof of the Mosque of *amīr* Qānībāy al-Muḥammadī (1314, Jaubert #30). This appears to be slightly skew to the mosque roof. The view is toward a wall that is at the back of the mosque and we might expect that the mosque is facing the Mamluk *qibla* for Cairo. But no, the mosque and the back of the *bādahanj* are aligned toward the "*qibla* of the Companions of the Prophet", that is, winter sunrise (Kessler 1972). There is some 10° between that direction (27° S of E) and the more prevalent "*qibla* of the astronomers" (37° S of E).

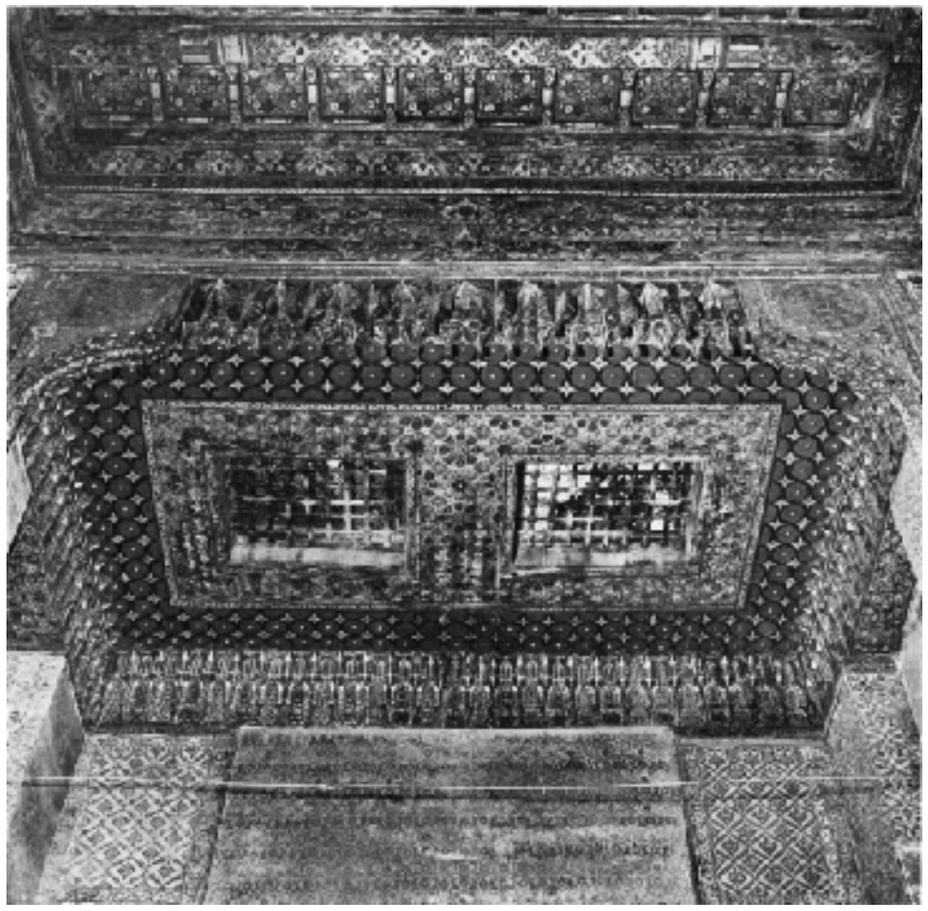
From Amenah F. Abdulkarim, *Building Craftsmen in Mamluk Society – The professional* muhandis *in context* (2017), fig. 1.12 (Creswell Archive, Ashmolean Museum, Oxford).

Q4

d. Opering of *melqaf* behiad pulpit

A replacement ‘pulpit’ in the Mosque of al-Ṣāliḥ Ṭalā’iʿ, which originally dates from 1160, hides a hole in the wall fitted with a pierced grille that is the lower end of a *bādahanj* which is the oldest known surviving example. On the other hand, we know that the Caliph al-Muʿizz delivered the Ramadan sermon from the pulpit next to the *bādahanj* in the al-Azhar Mosque already in the year 970.

Creswell, *Muslim architecture of Egypt*, II (1957), pl. 105d.



The grilles over the bottom of the air-shaft below the (no-longer-extant) *bādahanj* on the 15th-C Manzil al-Sādāt al-Wafā’iyya (Jaubert #40) in a recess in the S.E. of the large *īwān*.

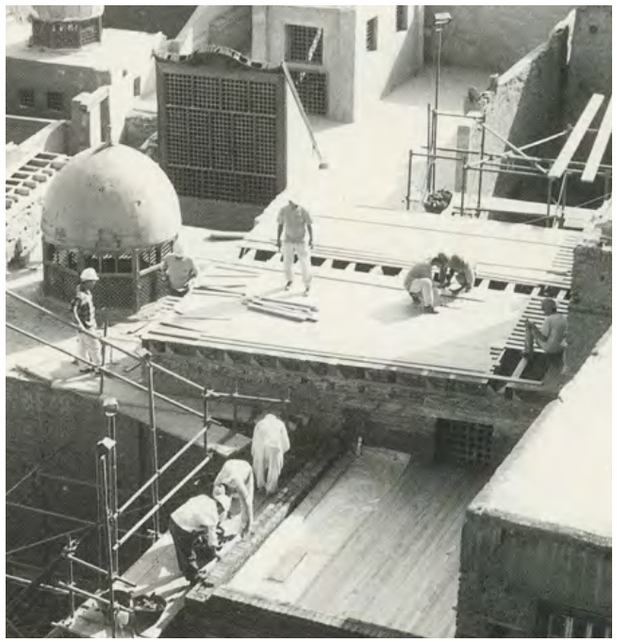
Raymond & Maury & Revault & Zakariya, *Palais et maisons du Caire, II: Époque ottomane (XVI^e^-XVIII^e^ siècles)* (1983), pl. 127.

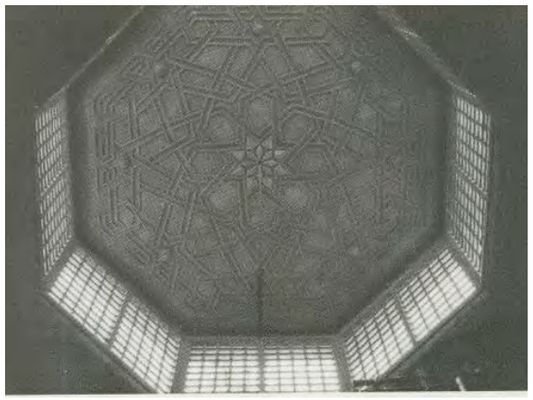
Q5

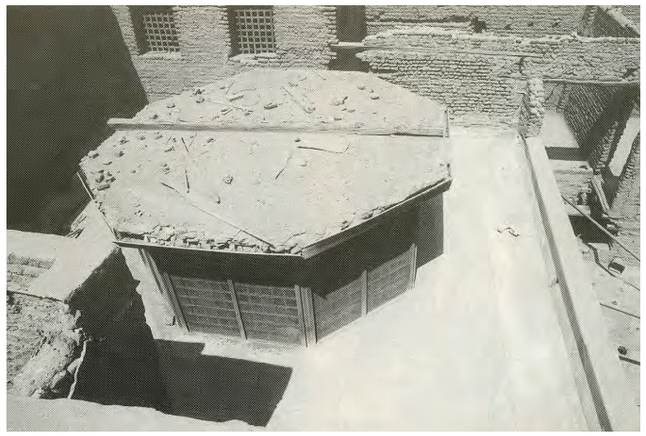
https://devian.tv/2018/09/12/takyeefbblash/

The wind-catcher on the roof of the Bayt al-Suḥaymī (Jaubert #46) from 1648 has been elegantly restored for tourists, alas incorrectly according to medieval principles. Before restoration the western side, to the right of the aperture with grill as seen from the outside and to the left as seen from the inside, would / should have been open.

Q5a







In 1996-97 a project was conducted to document, restore and conserve the Bayt al-Suḥaymī. The *malqaf* is not mentioned in the report; perhaps it had been restored previously. These photos from the project report show that the *malqaf* is not fully open to the winds but is partially blocked off by a small domed gallery, of which others are also visible. In the foreground of the above/right photo we see a *shakhshūkha*, whose windows and inner ceiling provide decoration and illumination for the large hall below. (The coloured image is a detail for comparison from a manuscript of the famous *Maqāmāt* of al-Ḥarīrī – see Pl. P3b.)

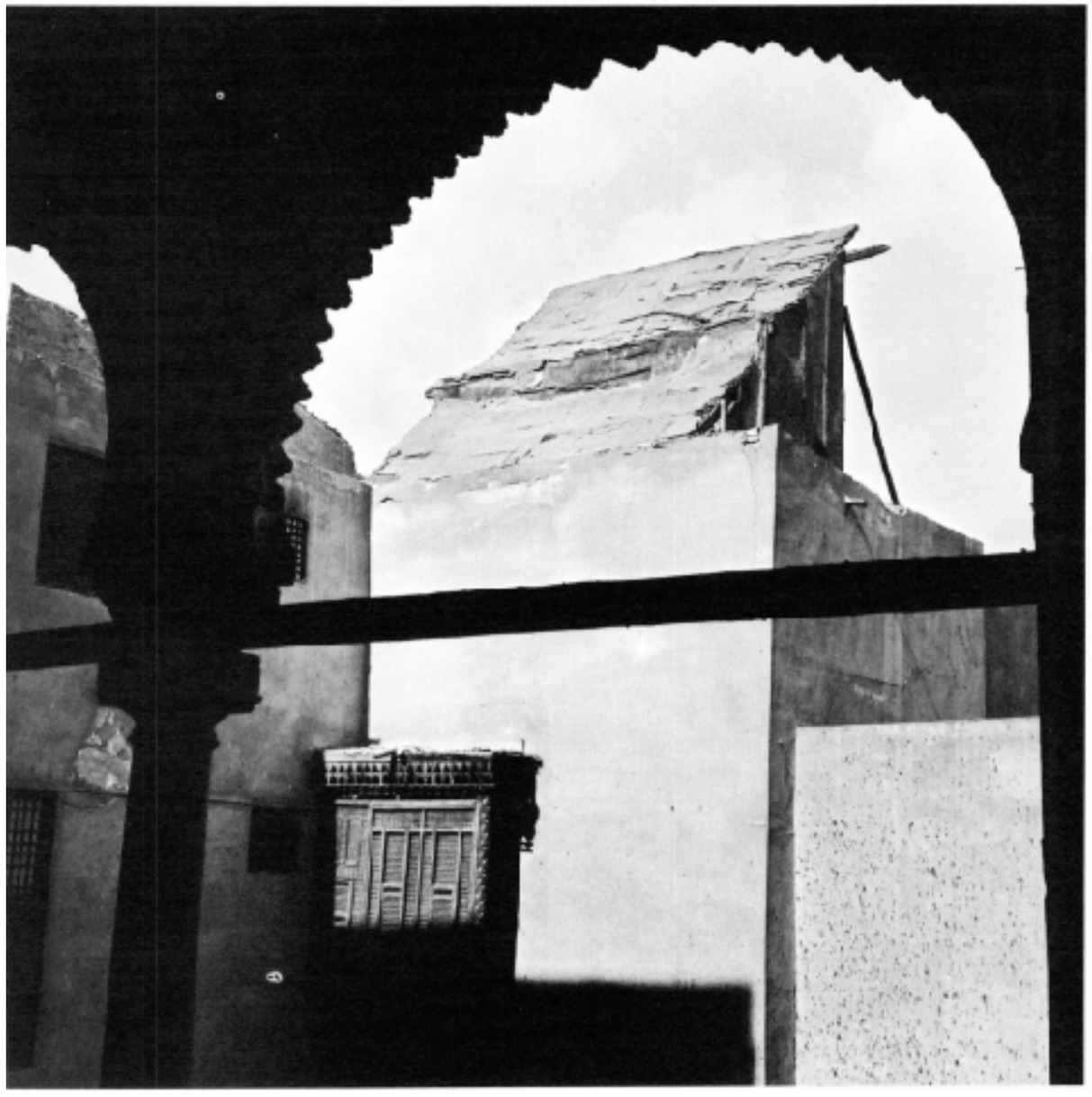
Bayt al-Suḥaymī 1996-97 report, pp. 36 / 8 / 9 / 33.

Q6

The inside of the wind-catcher on the Bayt al-Sinnārī. The left side, facing west, is open, as it should be. It looks as though the orifices have been fitted with glass windows.

Raymond & Maury & Revault & Zakariya, *Palais et maisons du Caire, II: Époque ottomane (XVI^e^-XVIII^e^ siècles)* (1983), pl. 133.

Q7



Fixed up to look cute … … .

Wazeri, *Natural cooling systems* (2001), p. 59.

**The back of the wind-catcher on the Bayt al-Sinnārī.
The wooden planks visible from the inside were clearly
originally covered with wattle on the outside.**

Raymond & Maury & Revault & Zakariya, *Palais et maisons du Caire, II: Époque ottomane (XVI^e^-XVIII^e^ siècles)* (1983), pl. 134.

«ملاقف» الهواء

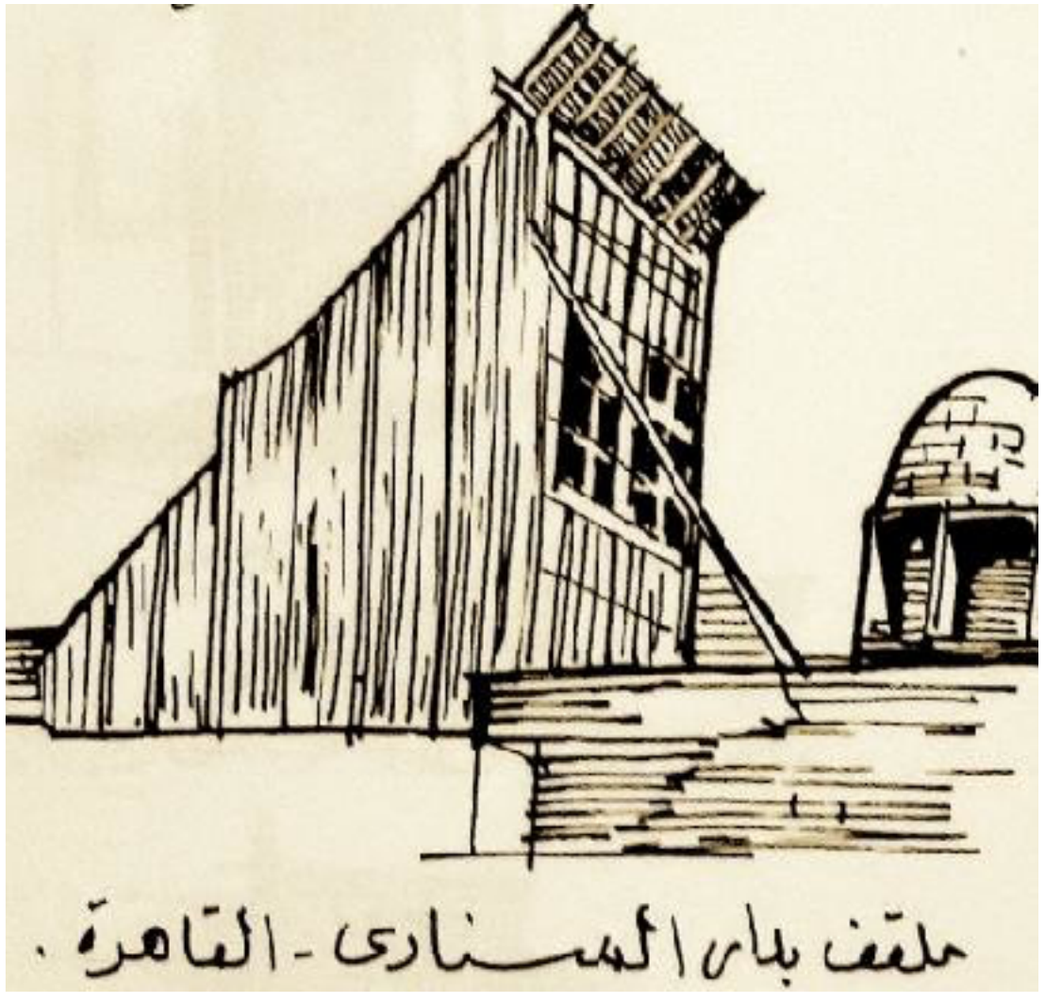
« الملاقف» .. بفتح الميم جمع ملقف وهى من العناصر المعمارية المهمة فى العمارة الإسلامية وإن كان ابتكارها يرجع إلى ما قبل العصر الإسلامى بكثير بل ويرجعه البعض إلى عصر القدماء المصريين، «ملقف الهواء» هو وسيلة رائعة لتبريد المبانى، وخاصة المنازل، فى فصل الصيف حين تزداد درجات الحرارة ، و هو عبارة عن برج يبرز أعلى سطح المنزل وله فتحة كبيرة فى الاتجاه الشمالى حيث تهب الرياح البحرية اللطيفة ويمكن أن يكون له أيضا فتحة أصغر فى اتجاه الغرب، هذه الفتحات لها نوافذ تغلق فى فصل الشتاء وتفتح فى الصيف، وقد يوضع عليها شبك صغير الفتحات لمنع دخول الحشرات أو الطيور، ويمكن أيضاً فى الأيام شديدة الحرارة وضع ستائر أو حصائر مبللة فيصبح الهواء الداخل أكثر برودة و كأنه جهاز تكييف طبيعى .

عمر الرزاز

A 2016 article in the Cairo daily *al-Ahram* about the wind-catchers of Cairo, illustrating the inside of the one in the Bay al-Sinnārī. The author, Omar al-Razzaz, claims that the devices go back to the Ancient Egyptians, but he is somehow better informed about the opening on the left-hand (western) side, which he states is closed in winter and open in summer.

Omar al-Razzaz, "*Malāqif al-hawā*", *al-Ahrām al-misā'iyya*, 22.05.2016.

Q9



In a recent study, a 20th-century unsigned drawing of a *malqaf*, identified in an Arabic caption as the one on the 1794 house of Ibrāhīm Katkhudā al-Sinnārī (Jaubert #56), acquires a label as a "dwelling house in Ancient Egypt with wind catcher in roof (1300 BC)".

El-Borombaly & Molina-Prieto, "Adaptation of vernacular designs" (2015), said to be from a Nordic site http://runeberg.org/nfbd/0393.html.

Q10

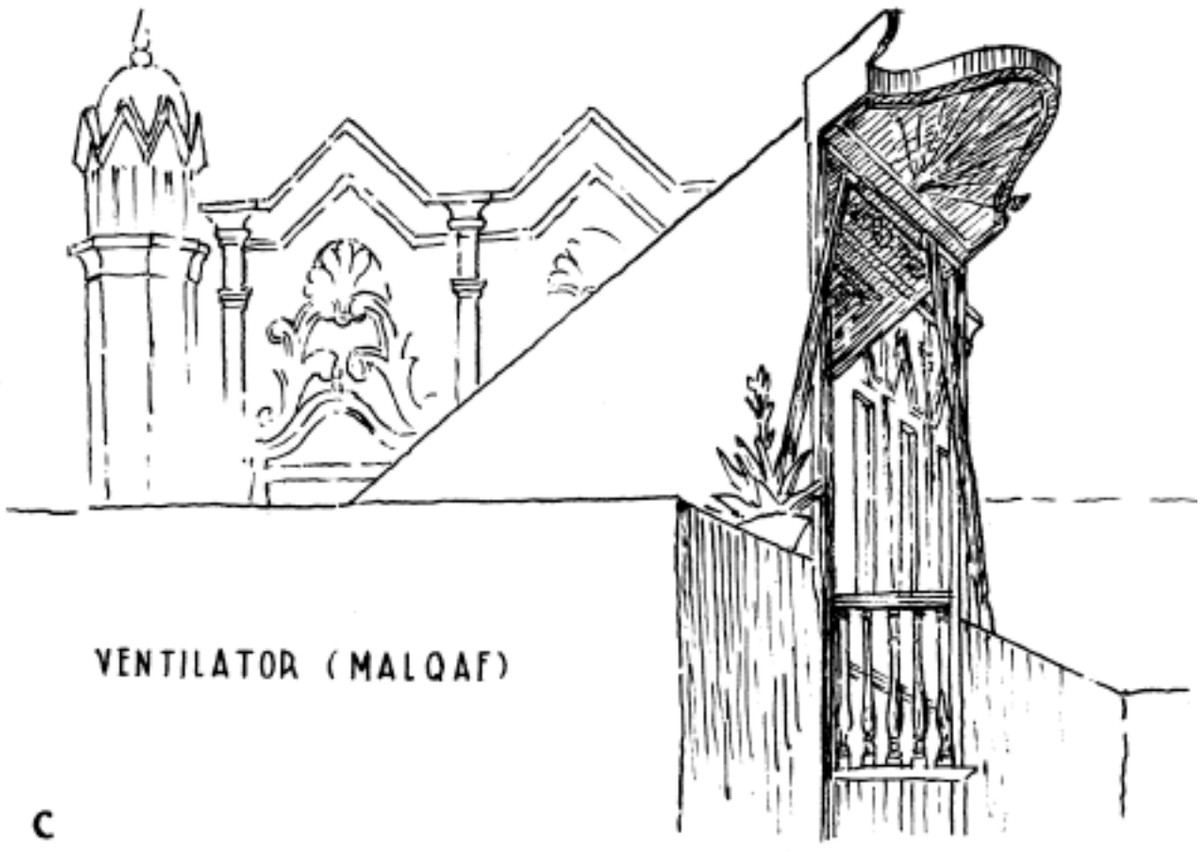


FIG. 4

An unidentified Cairene *malqaf* featured by Alexander Badawy in 1956.

A. Badawy, “Architectural protection against heat in the Orient” (1956), p. 132, fig. 4.

Q11

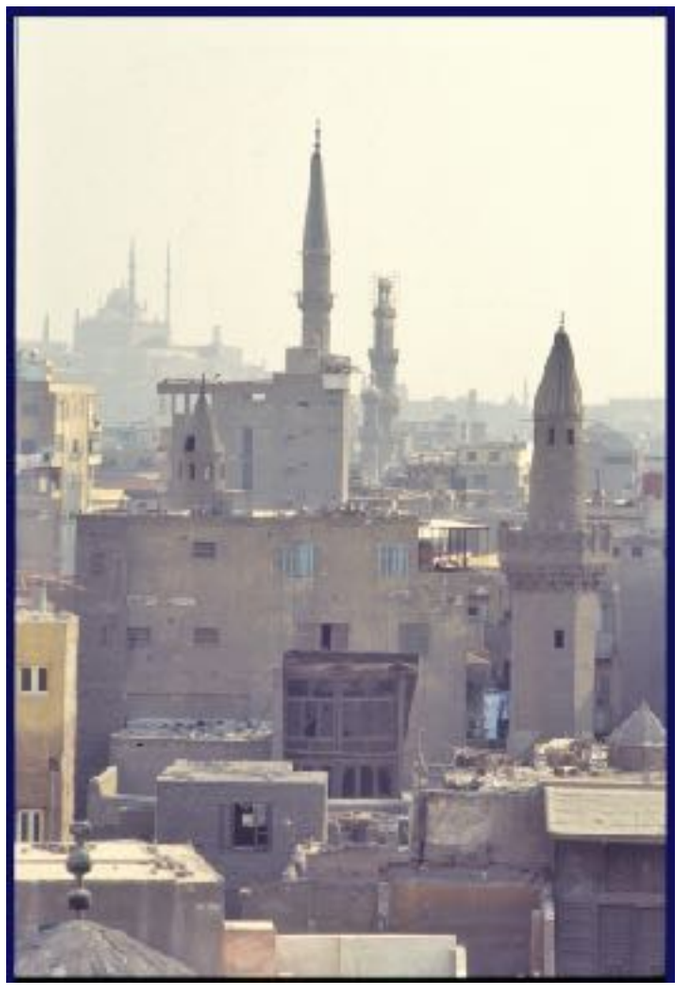
Another surviving wind-catcher in Cairo, this in the Palace of al-Jawhara (Jaubert #63), built in 1812 for Muḥammad ʿAlī in the southern enclosure of the Citadel. No illustration is available to show whether or not the side on the right is open or not.

Q12

The decorated top of the roof of the wind-catcher of the *sabīl-kuttāb* and *funduq* of Aḥmad Bāshā, 1864 (Jaubert #67).

Jaubert, “Les capteurs de vent en Égypte” (1995), p. 220. Image courtesy of Olivier Jaubert.

Q13



Above, a wind-catcher surviving on the roof of the Palace of al-Ḥarim (1827-43, Jaubert #64). It seems that the scoop is made of sheet metal covering both sides.

At right, an imposing wind-catcher on the roof of the Mosque of Maḥmūd al-Muḥarram (1792, Jaubert #55). It looks almost as large as the *bādahanj* on the Musāfirkhāne, which Palace belonged to the same rich merchant. On both, the west side of the scoop is open, as it should be.

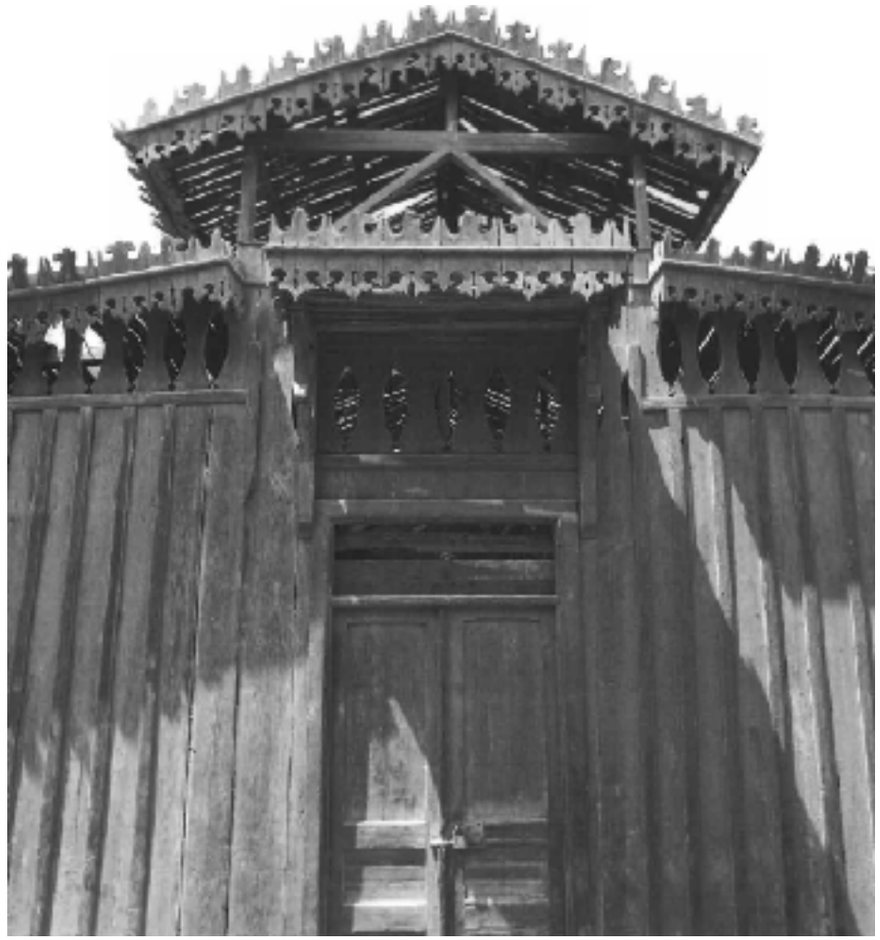
Photos from 1994, courtesy of Olivier Jaubert.

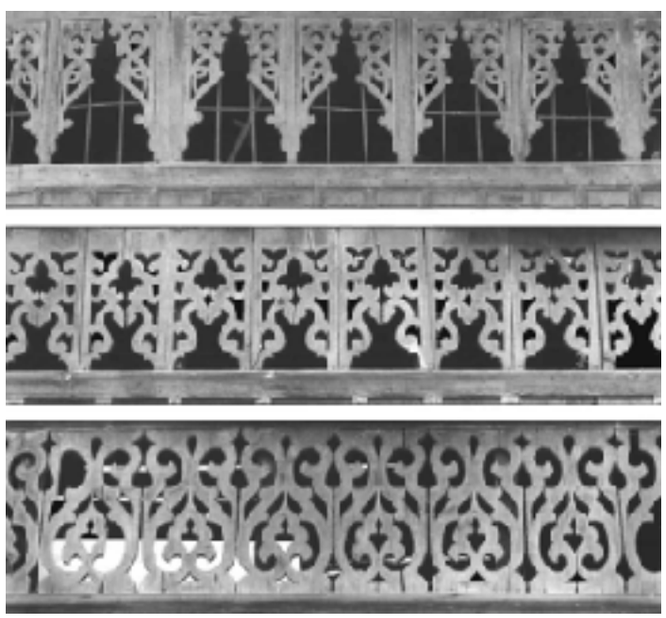
Q14

Like wounded soldiers on a battle-field of crumbling dried mud, these wind-catcher hoods make their last stand. They are found on the roof of a 19th-century *wakāla* (*okel*) or guest-house (Jaubert #73) in the vicinity of al-Azhar. Whoever might view them as a source of fire-wood risks falling into the air-shafts the hoods once served.

Photo from 1994, courtesy of Olivier Jaubert.

Q15

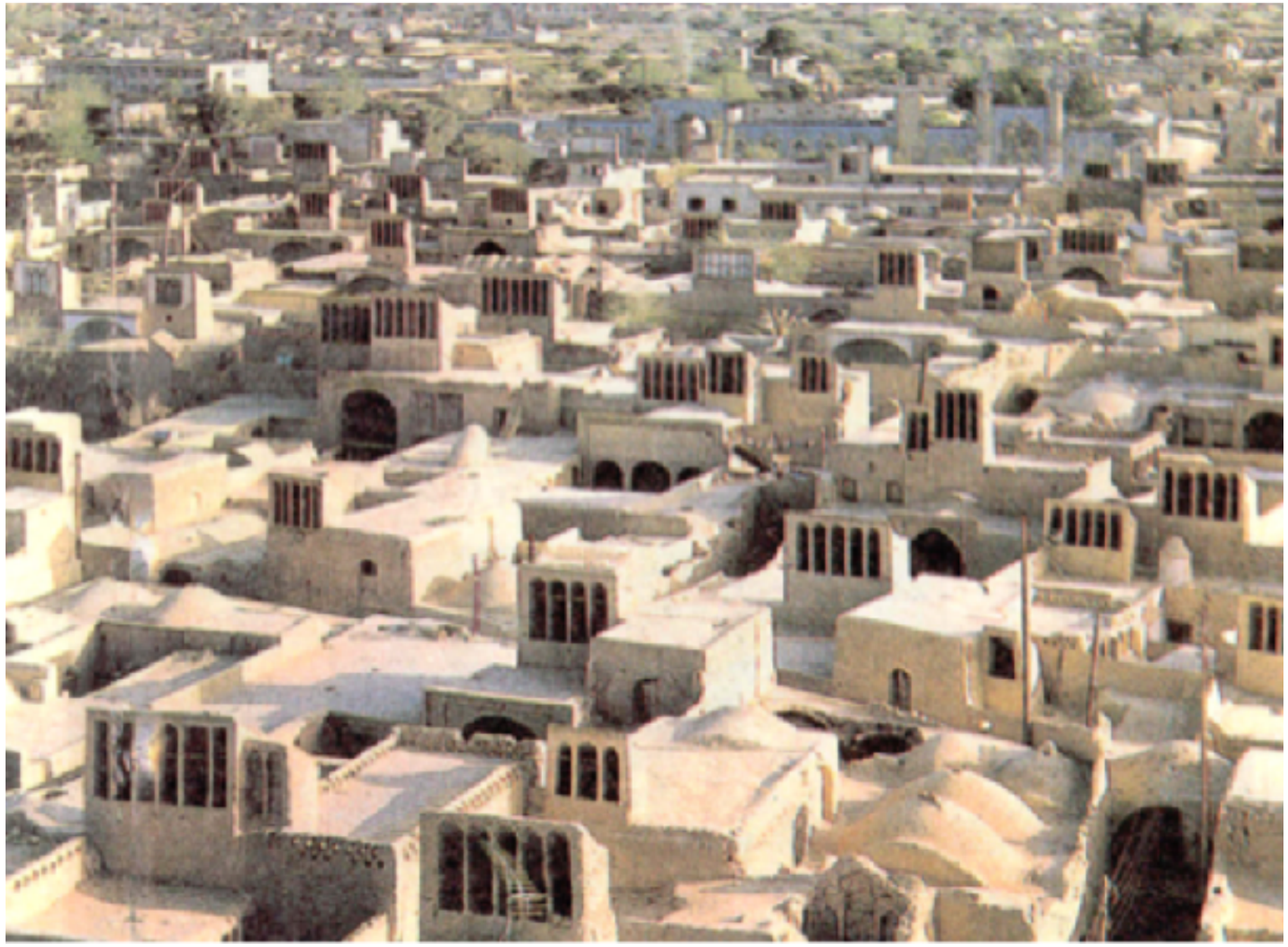




It would be amiss not to mention the decorative wooden ventilation devices on the more recent tombs, or rather, tomb encasements, in the City of the Dead. Dozens of such decorative openings are still to be found and have been faithfully documented.

Galila El Kadi & Alain Bonnamy, *La Cité des Morts - Le Caire* (2001).

Q16



Of all the Iranian wind-catchers known from the literature and from the internet, those still visible in Meybod, a small town some 50 km NW of Yazd, look closest to the Egyptian ones. First, they are uni-directional. Second, they have mainly sloping roofs, sometimes flat ones. These two prescriptions together are not satisfied in any other historical wind-catchers in Greater Iran. However, these scoops are not constructed out of wood. See also next Plate.

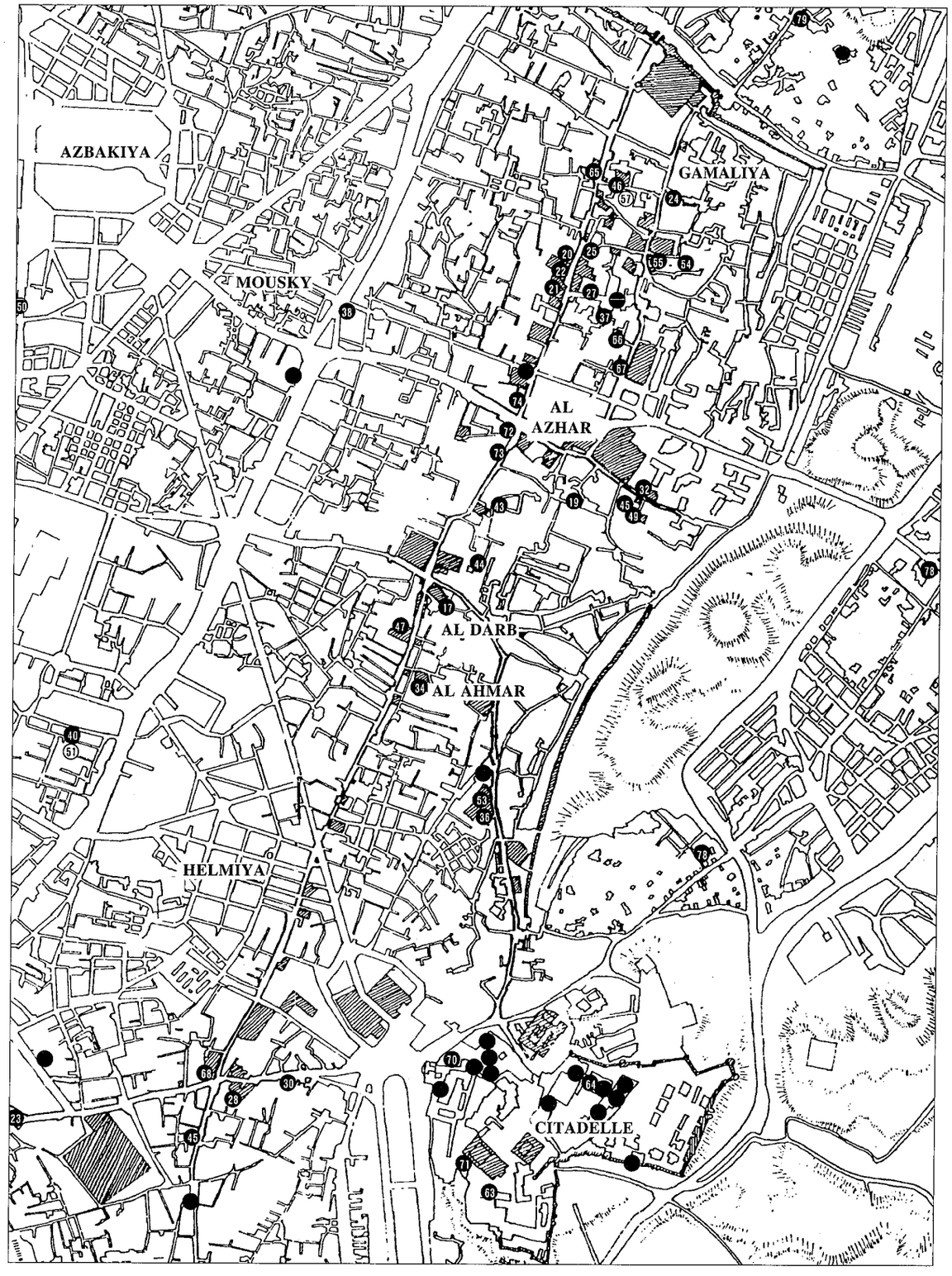
Alireza Dehghani-Sanij & Soltani & Raahemifar, "A new design of wind tower for passive ventilation" (2015), p. 183.

Q17

This magnificent view of Meybod shows some of its wind-catchers and wind-towers in all their glory. With certain reservations, this is how I imagine medieval Cairo, with *bādahanj*es from small and modest to monumental and splendiferous.

Bekleyen & Melikoğlu, "Windcatchers in Anatolia" (2019), p. 115, reduced from a wider image in www.kheshtomah.com/about-us.

Q18



△ **Fig. 22** Localisation des capteurs de vents sur le plan du Caire ; centre ancien, (d'après S. Noweir, M. Volait, *Le Caire*, *BIFA. Sup* 89, 1987).

Olivier Jaubert's localization of known wind-catchers in the central regions of what was medieval Cairo. It should be borne in mind that most domestic architecture from before 1800 here and in the medieval suburbs has disappeared without trace.

Jaubert, "Capteurs de vents au Caire" (1995), p. 231.

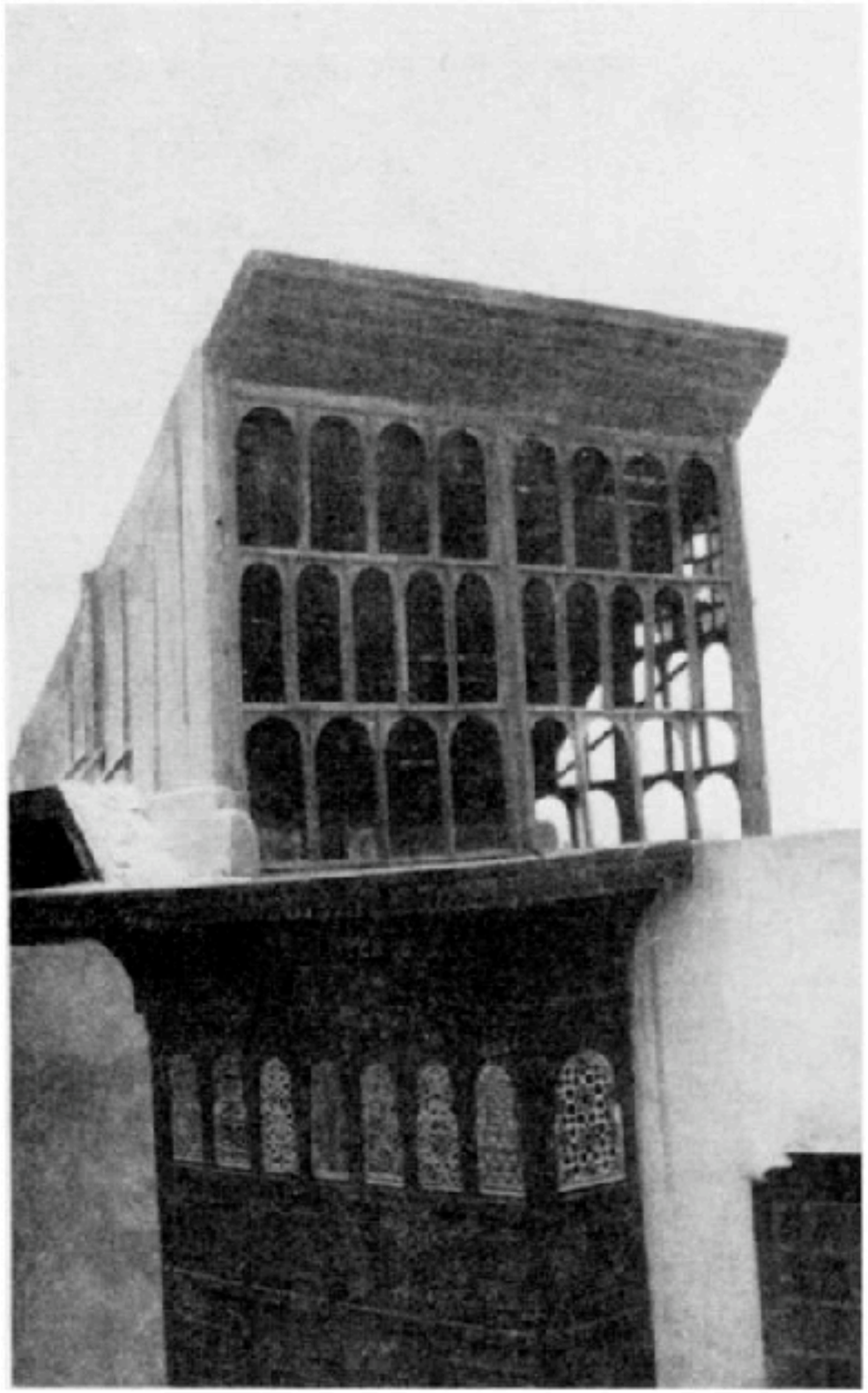
AnIsl 29 (1995), p. 169-231 JAUBERT (Olivier)
Capteurs de vents d'Égypte. Essai de typologie.
© IFAO 2019 AnIsl en ligne http://www.ifao.egnet.net

R: The *bādahanj* of the Musāfirkhāne Palace and its destruction

المسافرخانه من الجمال الى الاهمال

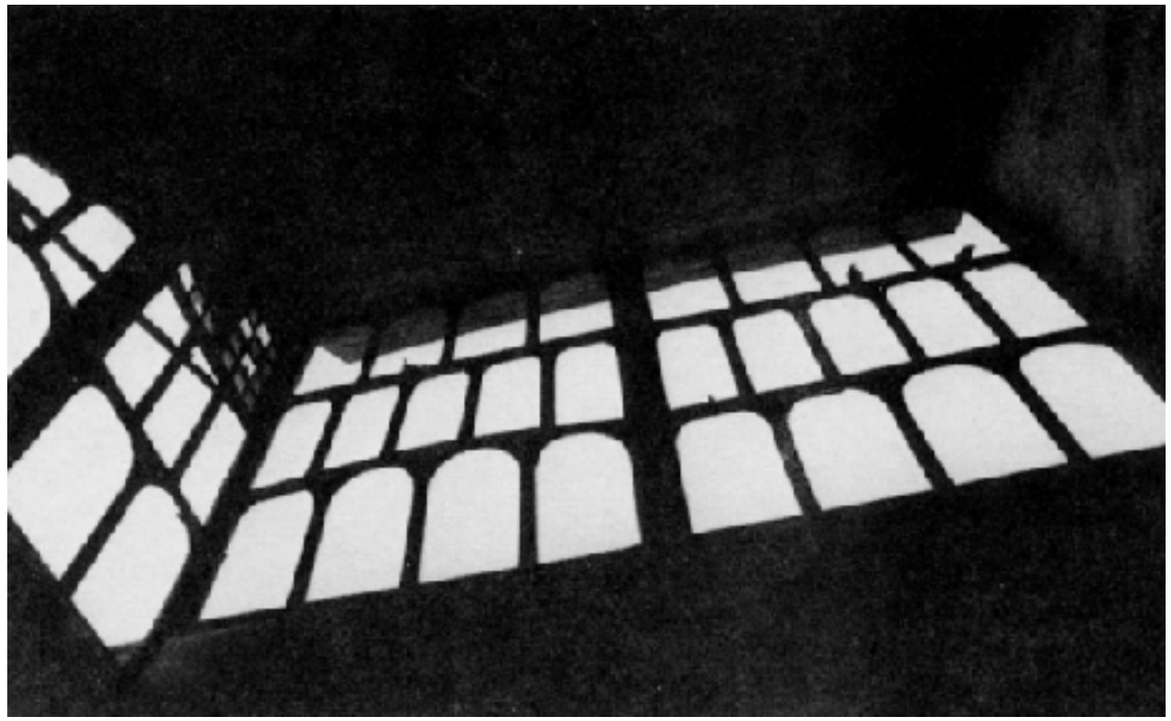
“You have a *bādahanj* like a sad (mourner) which has
A breath that has become laboured and painfully short.
The zephyr has died in it and all of us
Cry and mourn for it with tears of sweat.”
The Egyptian poet Abu ‘l-Fatḥ Ibn Qādūs (d. 1156)

R1

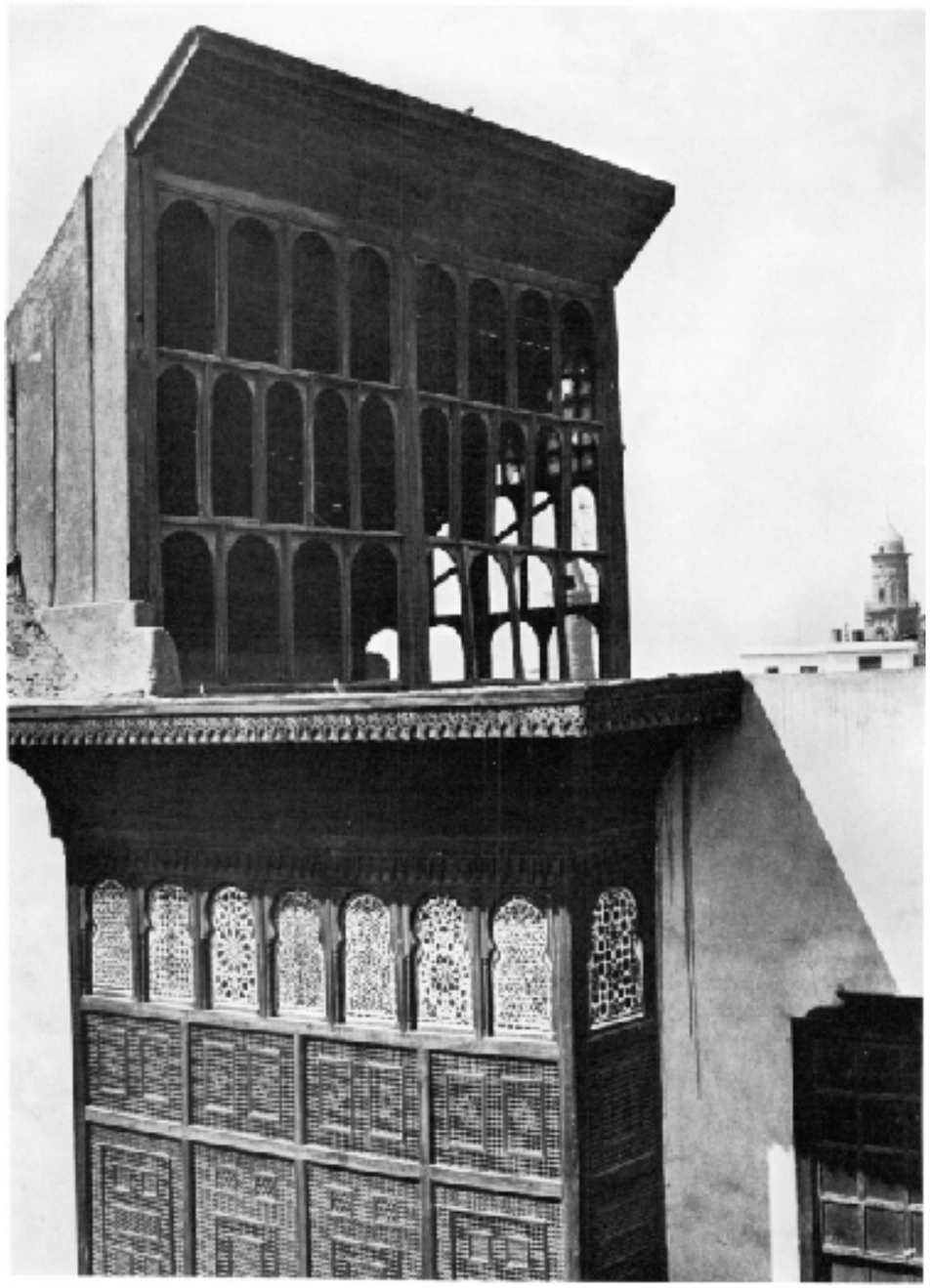


The front and inside of the splendid *bādahanj* of the Musāfirkāne Palace (Jaubert #54), built in 1779-1788. Notice that the west side is open, as described in the medieval astronomical sources. These images, taken by the author in the 1970s, are the more valuable now since the Palace burned down in 1998.

FotoDienst AbuMax

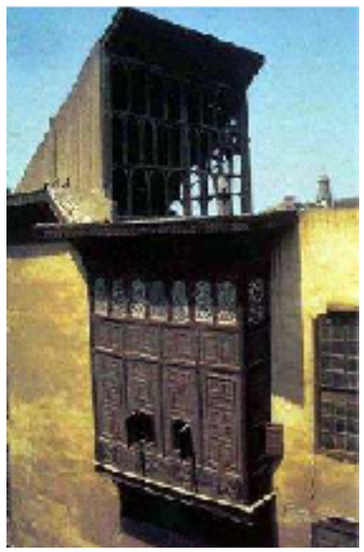


R2



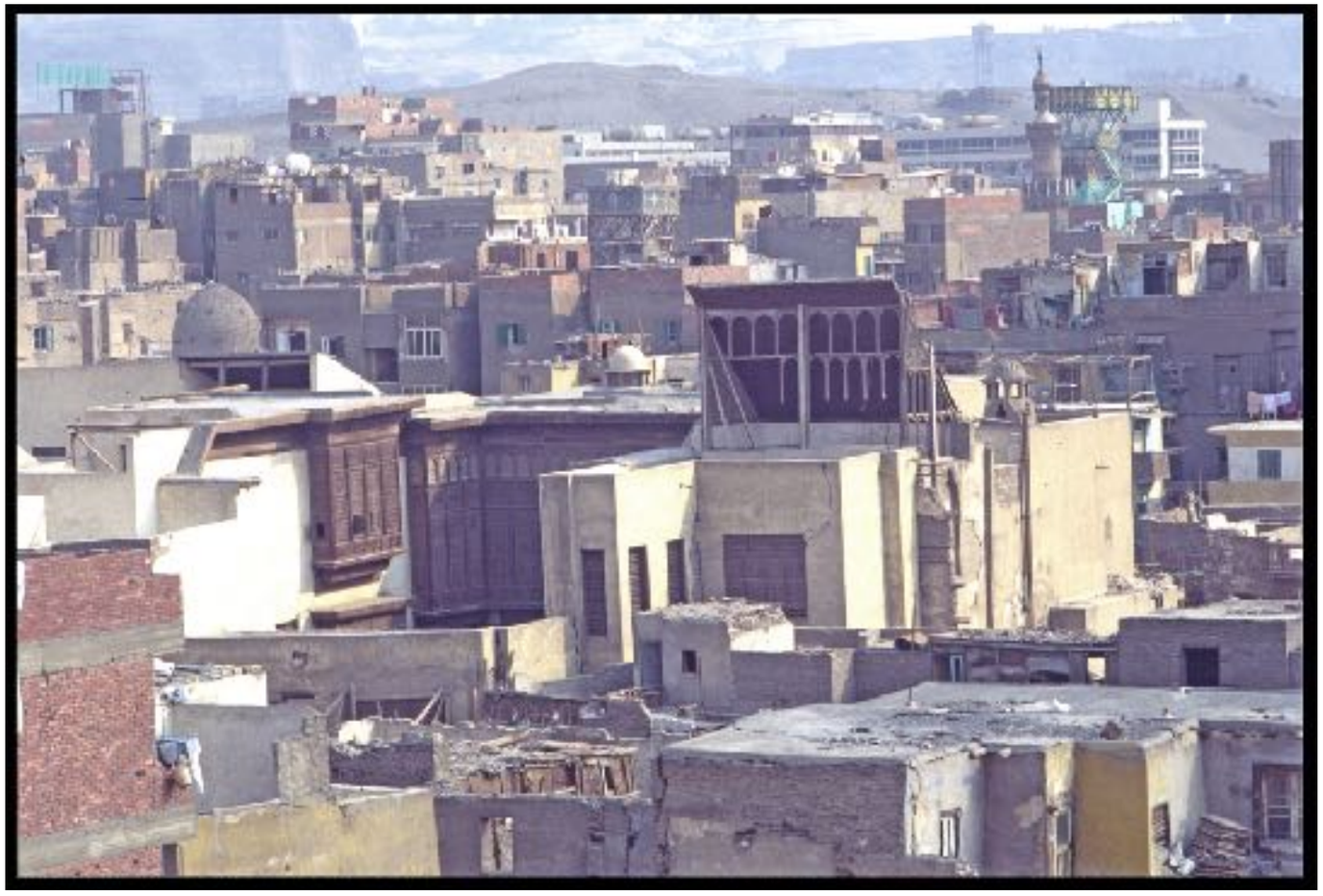
A superior photograph of the splendid wind-catcher on the roof of the Musāfirkhāne Palace, together with the *mashrabiyya* on the storey below it. The west side (here on the right) is open, as it should be according to medieval prescriptions.

Raymond & Maury & Revault & Zakariya, *Palais et maisons du Caire, II: Époque ottomane (XVI^{e}-XVIII^{e} siècles)* (1983), pl. 100.



Had Hassan Fathy exploited the medieval wind-catchers, they would not have fallen into oblivion. This image is originally from James Steele, *An Architecture for People: The Complete Works of Hassan Fathy* (1997).

R3



The *bādahanj* of the Musāfirkhāne already in a state of collapse in 1994, as shown in this rare photo from afar by Olivier Jaubert, the scholar who has done most to document the wind-catchers that were the symbol of medieval Cairo.

This photo of the *bādahanj* interior shows part of the foreground on the right-hand side blocked by some unidentified object (surely not a corpse as in the *1001 Nights*).

Photo by Prof. Nasser Rabbat (1985) at https://archnet.org/sites/2371/media_contents/6001.

R4

Tourists witness the devastation of the Musāfirkhāne after the fire in 1998, and some are brought to tears. It is unlikely that they will have been informed of the fact that the last splendid example of a Cairo wind-catcher went up in flames with the Palace. This is not even mentioned in the press reports.

Sara Nur, “The Musafirkhane in pictures ... The most beautiful historical palace in Cairo (reduced to a scene of) devastation” (2018 - why so late?).

R5

With the wanton destruction of the Musāfirkhāne Palace, the world, not just Egypt, has lost the last surviving monumental *bādahanj* constructed in the Fatimid / Mamluk / Ottoman tradition (10th-19th C).

Press reports and later references indicate that nobody knew this at the time.

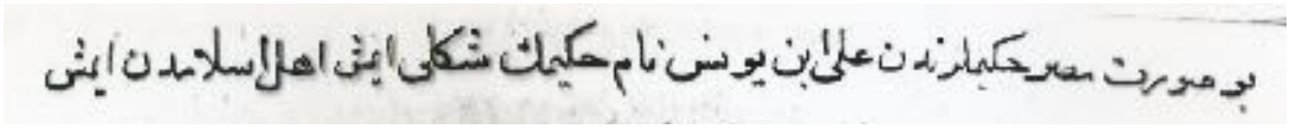
S: Astronomical and meteorological aspects of the *bādahanj*es

Some 2,500 Arabic, Persian and Turkish scientific manuscripts are preserved in the Egyptian National Library. This was the obvious place to look for manuscripts relating to the *bādahanj*es of medieval Cairo.

Photo (not of ENL) by the Spanish artist Manolo Valdes. www.pinterest.de/pin/352266002076298380/.

S1

A fanciful miniature in an enormous astrological text, *al-Qānūn fi 'l-dunyā*, by Ibn Zunbul al-Maḥallī (d. *ca*. 1570). It depicts Ibn Yūnus (d. 1009) with a copy of his astronomical handbook (*zīj*) and the Fatimid Caliph al-Ḥākim apparently berating him.



MS Istanbul Topkapı A 6562, fol. 254v, courtesy of the Topkapı Palace Library – see King, "An illustration of al-Ḥākim and Ibn Yūnus", p. 152.

In fact, the complete *zīj* is known to have filled four such volumes. The so-called "Hindu-Arabic numerals" on spine of this bound volume are totally inappropriate because these were never used in Islamic astronomical works. Further, the Caliph should have been happy to receive such a splendid work dedicated to him.

It may well be that Ibn Yūnus was consulted about the arrangement of the wind-catchers in the new city of al-Qāhira. The earliest recorded pronouncements about their shape and their orientation are attributed to him. Ibn Yūnus was also a poet and examples of his poetry survives in various biographical notices, including erotic verses about the winds.

The title-page of the *Ḥākimī Zīj* of Ibn Yūnus, the astronomical handbook with tables prepared for the Fatimid Caliph al-Ḥākim *ca*. 1000. The work is only partially extant, about three-quarters of it surviving in manuscripts in Leiden, Oxford and Paris. Some missing materials have been found in Yemeni manuscripts. This title-page includes a brief biography of Ibn Yūnus in the distinctive hand of the leading astronomer in Egypt at the end of the 15th C, Ibn Abi 'l-Fatḥ al-Ṣūfī. It also bears on the right hand side a notice of possession of the Istanbul astronomer Taqi 'l-Dīn ibn Maʿrūf *ca*. 1577. The manuscripts of his short-lived observatory were sold *ca*. 1627 to the Dutch orientalist and mathematician Jakob Golius, and they remain to this day safe and available to scholars in the Library of Leiden University.

MS Leiden UB Or. 143, fol. 1r, courtesy of the Universiteitsbibliotheek.

S2a

Extracts from a typical ephemeris (*taqwīm*) giving for each month of a Hijra lunar year (on a double page) information (in the heading) about the conjunction of the sun and moon at the beginning of the month, and the associated crescent moon. Then for each day of the month we find (on the right) the longitudes of the sun, moon and five naked-eye planets, and the supposed astrological significance (in words, on the left) implied by the position of the moon relative to those of the other celestial bodies. Several horoscopes are included in the work. Ephemerides such as this were prepared each year in various astronomical centres in the Muslim world from al-Andalus to Central Asia. This fine specimen is for the year 727 H (1326/27) and was compiled in the Yemen, where there was a lively tradition of mathematical astronomy for over a millennium, strongly influenced by Ibn Yūnus. Fortunately, nobody threw it out at the end of the year, when its utility had expired.

From MS Cairo DM 817,2, courtesy of the Egyptian National Library. Details in King, *Astronomy in the Yemen* (1983), p. 33 & pls. 2-3.

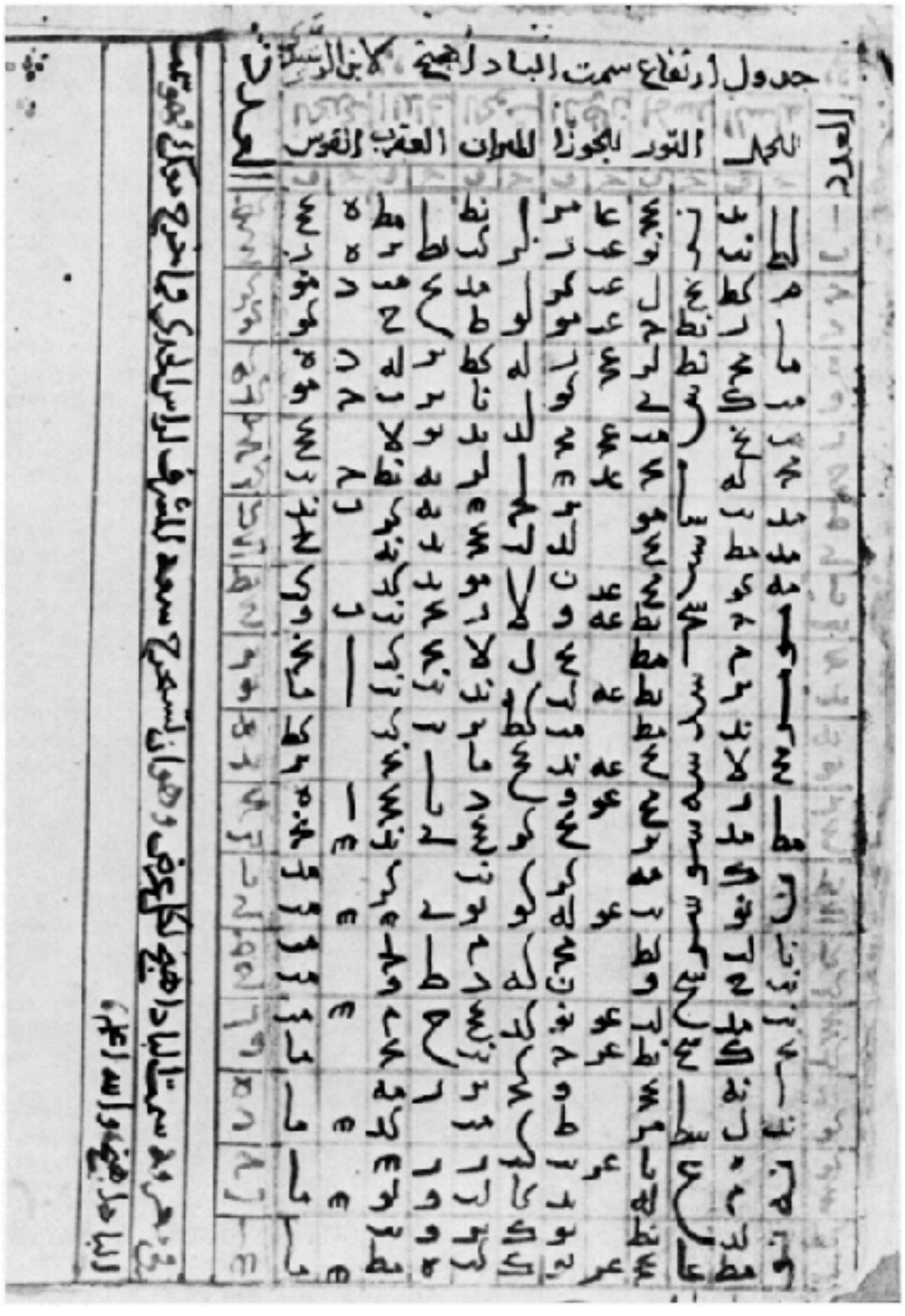
S3

The title and first few lines of a particularly interesting table in the Cairo corpus of tables for astronomical timekeeping and regulating the times of the five daily prayers. The table displays

ارتفاع الشمس اذا مرت بسمت الباذاهنج

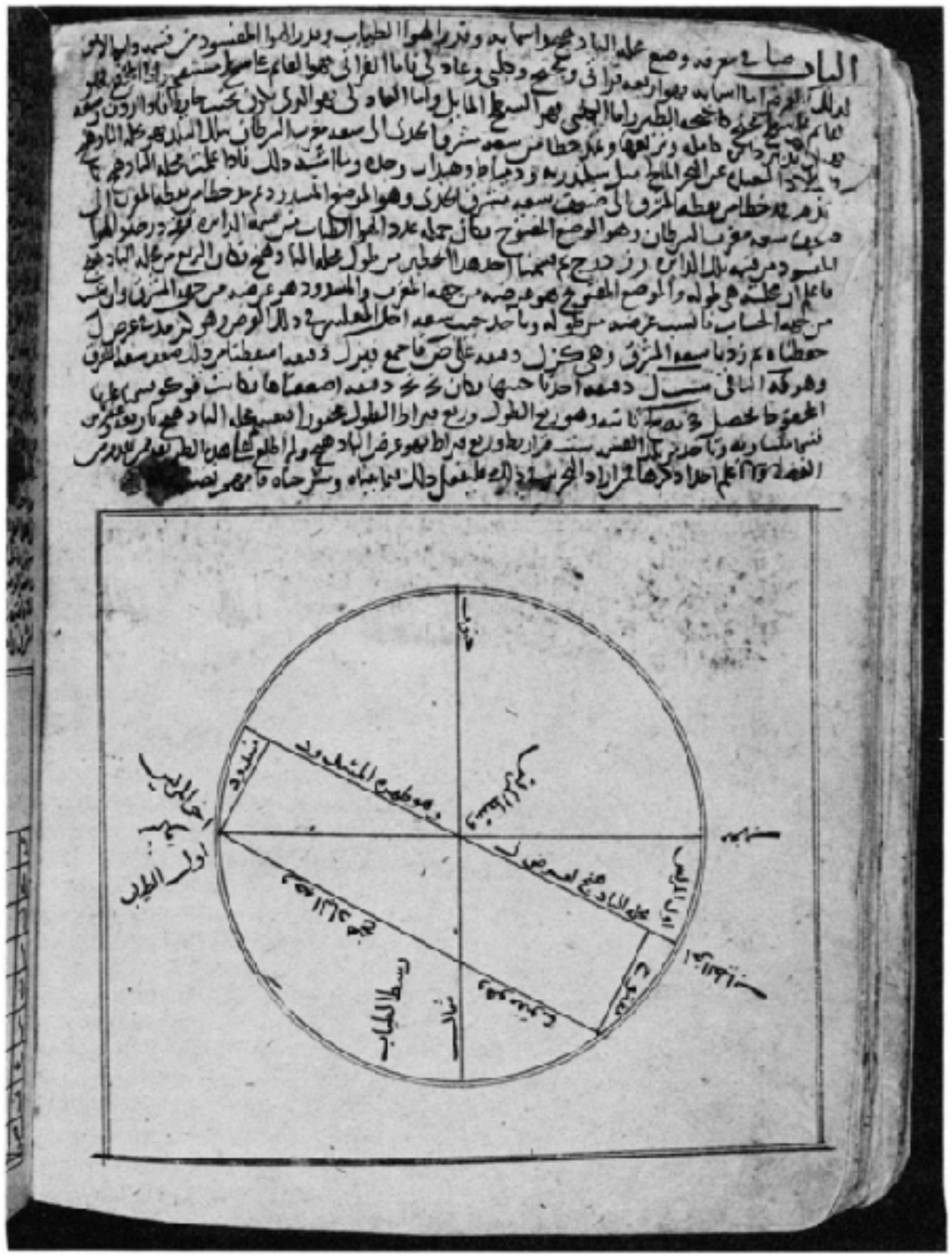
"the altitude of the sun when it passes by the azimuth of the *bādhāhanj*". Values are given in degrees and minutes in the standard Arabic alpha-numerical (*abjad*) notation for each degree of solar longitude (corresponding roughly to each day of the year) from 1° to 30° of each zodiacal sign, exploiting the symmetry of the function. The entries serve roughly each day of the year. This format is standard for the entire corpus of some 200 tables.

The table tells us that the back axis of the *bādahanj* was to be aligned toward winter sunrise. Why?



In this copy of the Cairo corpus, the table for the *bādāhanj* is attributed to the enigmatic Egyptian astronomer Ibn al-Rashīdī (*ca*. 1300), otherwise known as the compiler of an extensive corpus of tables for the latitude of Jerusalem. He also corrected various tables by Ibn Yūnus which had become corrupted by careless copyists. The note to the left of the table states: "On finding the azimuth of the *bādāhanj* for every latitude: you calculate the rising amplitude (of the sun) at the first point of Capricorn (*i.e*., winter solstice), and the result will be the azimuth of the *bādāhanj*, but God knows best."

MS Cairo DM 758, fol. 4r, courtesy of the Egyptian National Library.

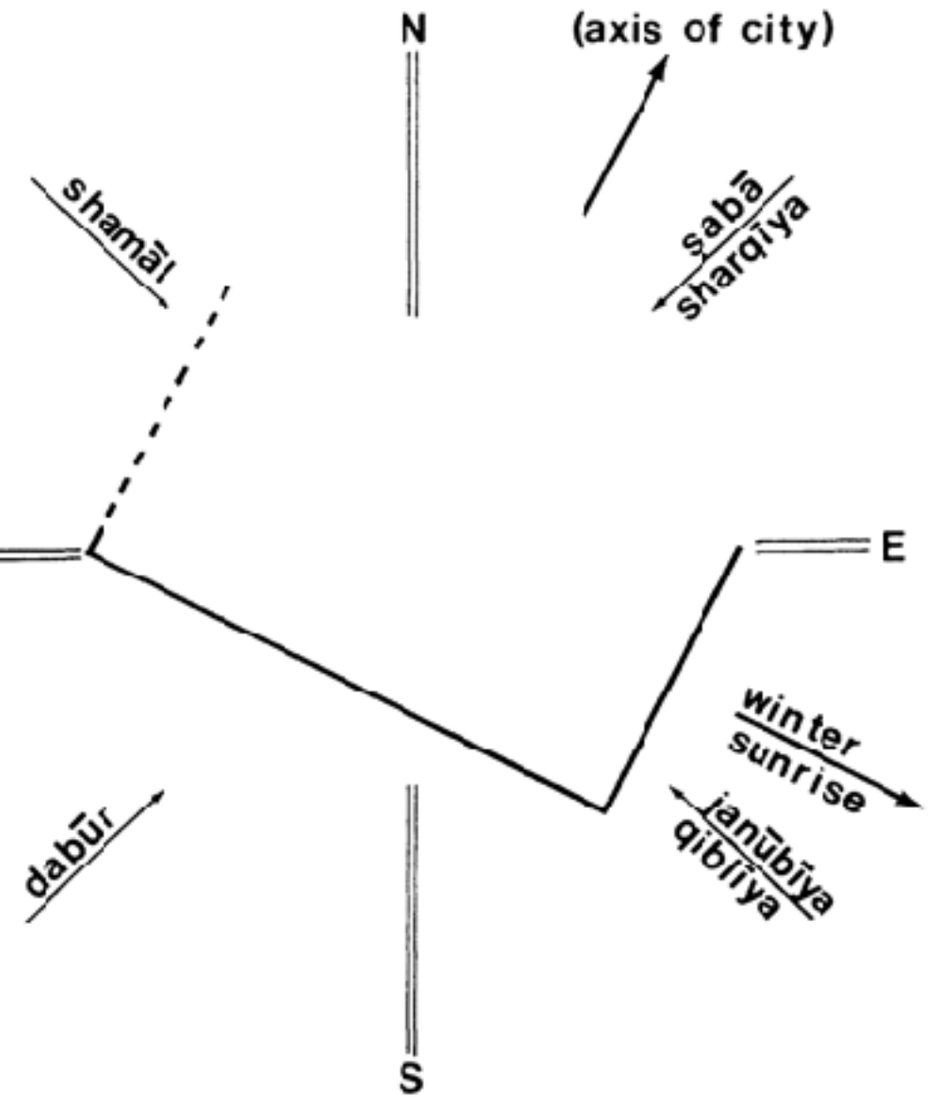


The chapter on the construction of the *bādahanj* in the treatise on astronomical instruments by the Egyptian astronomer Najm al-Dīn al-Miṣrī, compiled in Cairo around 1325.

Instructions for laying out the contraption are accompanied by a diagram showing the orientation of the back toward winter sunrise in the east & summer sunset in the west, and the front open to the lower left, with the north-west side open & the north-east side closed. In this way, the wind-catcher is open to all favourable winds and closed to all unfavourable ones.

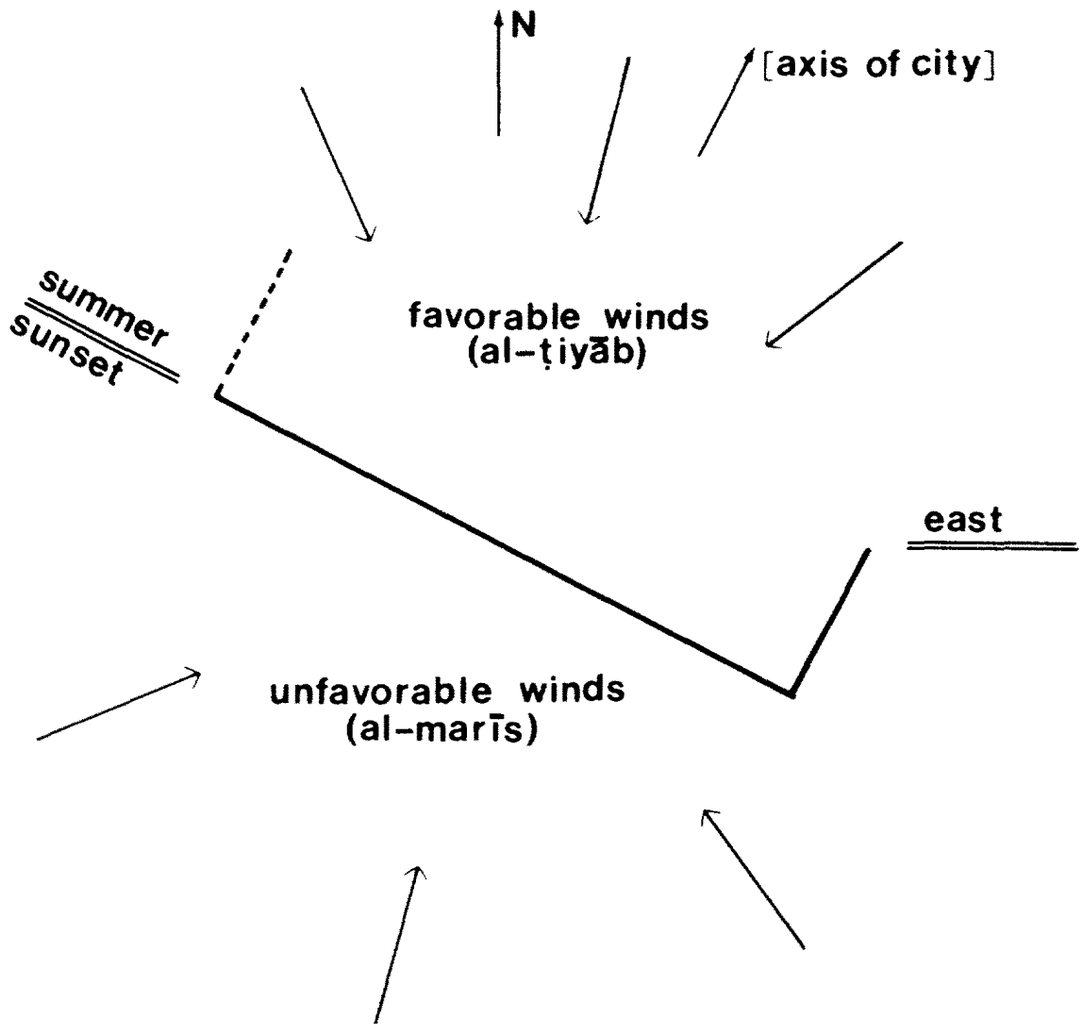
MS Dublin Chester Beatty 102, fol. 52v, courtesy of the Chester Beatty Library.

"A *bādahanj* in which the air of east and west
Flows according to the best manner and method
When the winds of the atmosphere come to it in disarray,
They blow in it in no other way but an orderly one.
The poet Burhān al-Dīn al-Qīrāṭī, Cairo, *ca*. 1350.



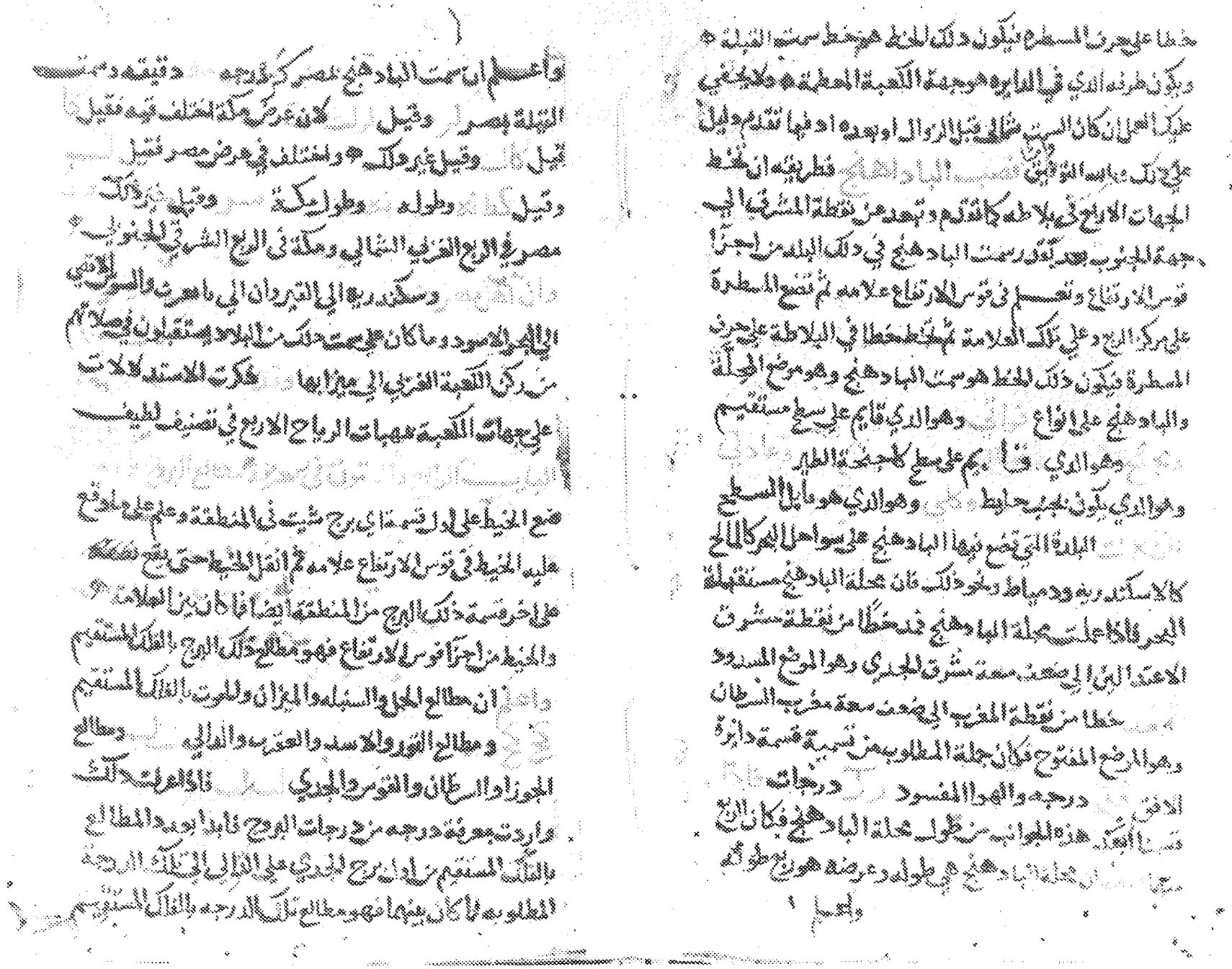
The limits of the winds in medieval Egyptian folklore as reported by the 14th-C encyclopaedist al-Qalqashandī and their relation to the orientation and shape of the wind-catchers as described by Ibn Yūnus four centuries previously.

King, "Architecture and astronomy", p. 120.



The limits of the favourable and unfavourable winds in Egyptian folklore as described by Najm al-Dīn al-Miṣrī.

King, "Architecture and astronomy", p. 120.



The section of the treatise on the astrolabe quadrant by the 14th-C Cairo legal scholar Ibn al-Qāṣiḥ in which he discusses the orientation of the *bādahanj* and the *qibla* in Cairo.

MS Cairo DM 26, courtesy of the Egyptian National Library.

Chapter-titles and numbers in *abjad* notation are written in red ink and are unfortunately barely visible here.

S9

From Ebers, *Aegypten in Bild und Wort*, (1879), pl. 251.

https://archnet.org/media_contents/61889.

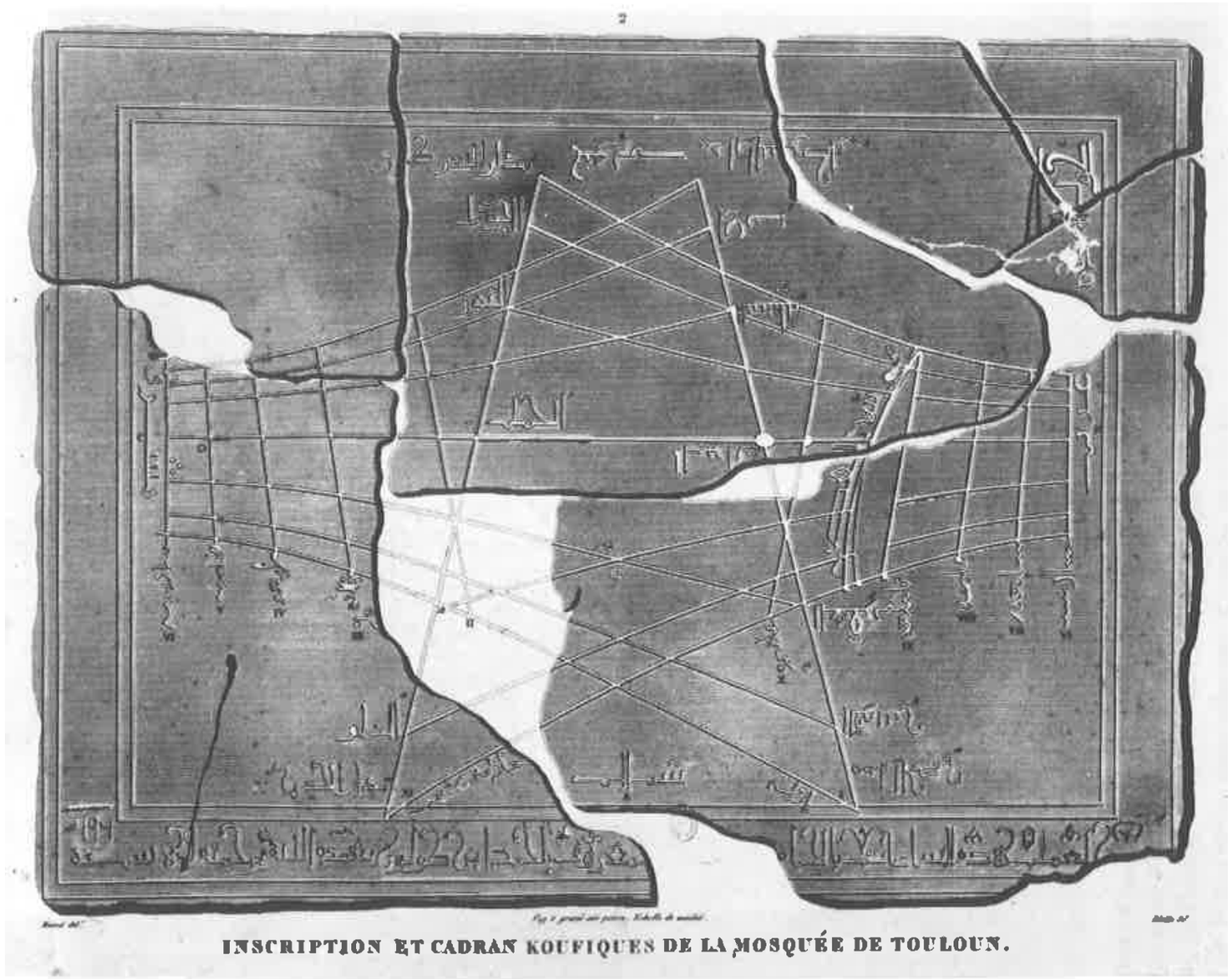
www.courtauldprints.com/image/146576/.

Postcard image presented to the author by Dr Michael Meinecke in Cairo around 1970.

There is more to the splendid Mosque of Ibn Ṭūlūn, completed in 879, than meets the eye. First, in 1296 a sundial was constructed for the Mosque indicating the times of the daylight prayers which was more sophisticated than any sundial known to us from medieval Europe. An engraving was prepared of the fragments and included in the *Description de l'Égypte*. Second, in the middle of the 17th century the astronomer ʿAbd al-Raḥmān al-Ṭūlūnī was active in the Mosque as *imām* and *muwaqqit* and possessed a remarkable library of important astronomical manuscripts, probably housed in the small room at the side of the dome at the centre of the court-yard. Some two dozen of these survive in different libraries, having been identified by his distinctive mark of ownership. The sanctuary of al-Ṭūlūnī was destroyed during renovations.

King, "On the role of the muezzin and *muwaqqit* in medieval Islamic society" (1996), pp. 313-317, & *In Synchrony with the Heavens*, vol. 2 (2005), pp. 660-665.

S10

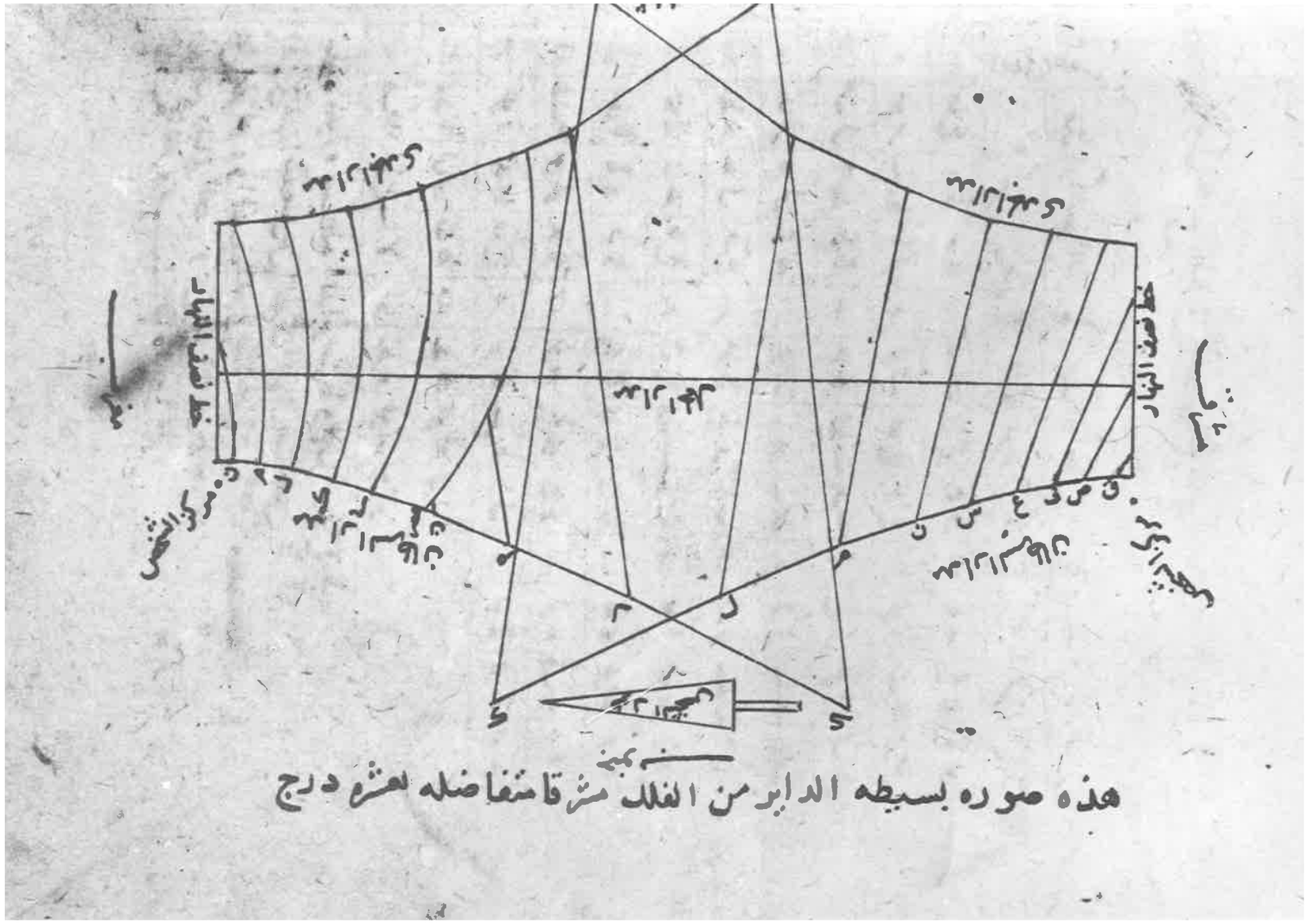


INSCRIPTION ET CADRAN KOUFIQUES DE LA MOSQUÉE DE TOULOUN.

The fragments of a marble sundial dated 1296 found by Napoleon's scholars in the Mosque of Ibn Ṭūlūn. After they had prepared a lithograph of the ordered fragments, the latter disappeared and have never resurfaced. This unusual type of horizontal sundial is of considerable historical interest and is attested also in Egyptian treatises on the construction and use of sundials – see the next image. Such splendid sundials would have adorned the major mosques in Cairo; now only simpler, more banal, late Ottoman ones can be found.

***Description de l'Égypte*, *É.M.*, II, pl. c / 746, analyzed in Janin & King, "Le cadran solaire de la Mosquée Ibn Ṭūlūn au Caire" (1978).**

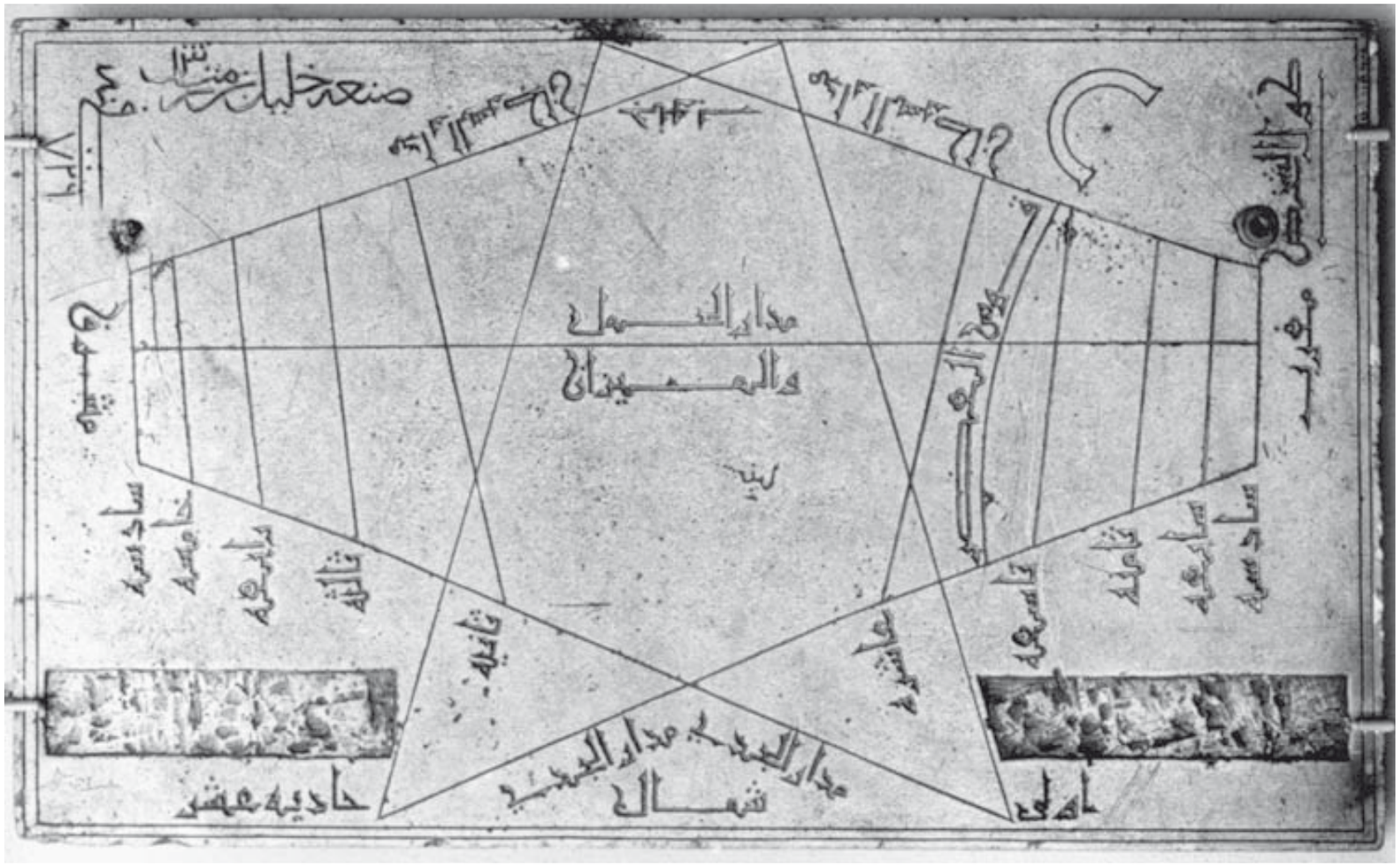
S11



A diagram in an Egyptian treatise on gnomonics – the construction and use of sundials – by the astronomer al-Muhallabī in 1425. The sundial illustrated is similar in principle to the one from the Mosque of Ibn Ṭūlūn: the two halves of a standard horizontal sundial are here superposed (mainly to save on marble). The markings show the time remaining to the prayers of the *ẓuhr* (midday), *ʿaṣr* (close to mid-afternoon) and *maghrib* (sunset). It is not generally known today that Cairo and Damascus were the world centres of gnomonics in 13th-14th C.

MS Dublin Chester Beatty 3641, fol. 11v, courtesy of the Chester Beatty Library, from Janin & King, "Le cadran solaire de la Mosquée Ibn Ṭūlūn au Caire (1978). See also the article "Mizwala (sundial) in *Enc. Islam*, 2nd end.

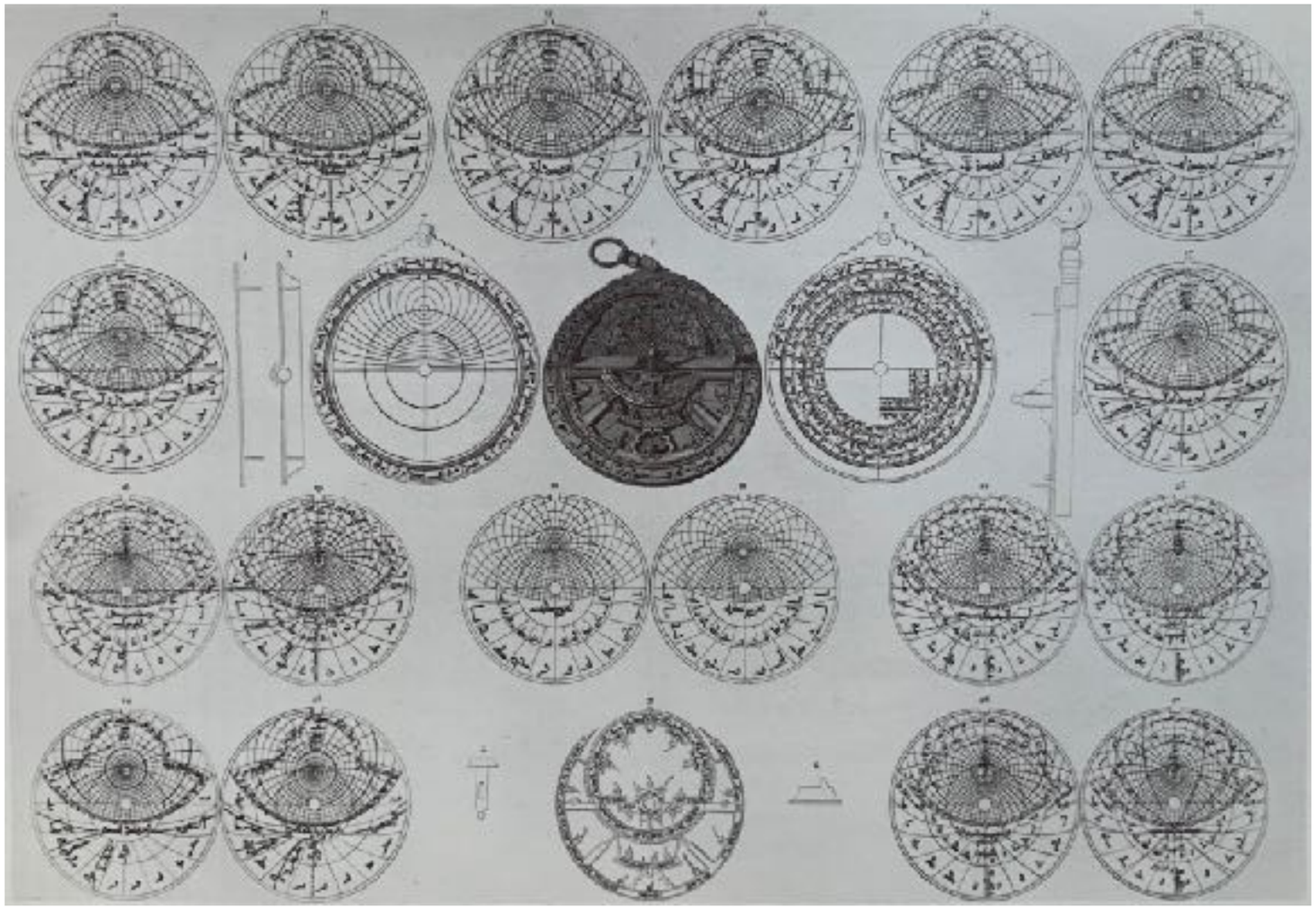
S12



A horizontal sundial made in Cairo in 726 H (= 1325/26) by Khalīl ibn Ramtāsh, otherwise unknown to us. The two halves of the sundial have been superposed, doubtless because marble was expensive, and the meridians and gnomon-holes for each half are at the sides. Such sundials are described in contemporaneous Mamluk treatises on gnomonics. The curve for the *ʿaṣr* is clearly marked on the half serving the afternoon, and the *qibla* at Cairo is indicated by the semi-circular "*miḥrāb*" nearby. The latter indicates a direction of 34° S. of E. (not attested elsewhere) rather than the usual 37° accepted by Mamluk astronomers. Instead of the hyperbolae usual for the solstitial traces we find rectilinear segments joining the extremities of the first/last hour with the midday shadows, that is, outside the domain of the shadows. Both gnomons are lost, but their length is indicated by a straight line (طول الشخص) in the corner near the *miḥrāb*. What was surely a dedicatory inscription or a statement about an endowment to a mosque or madrasa has been deliberately effaced.

Courtesy of The Victoria and Albert Museum, London.

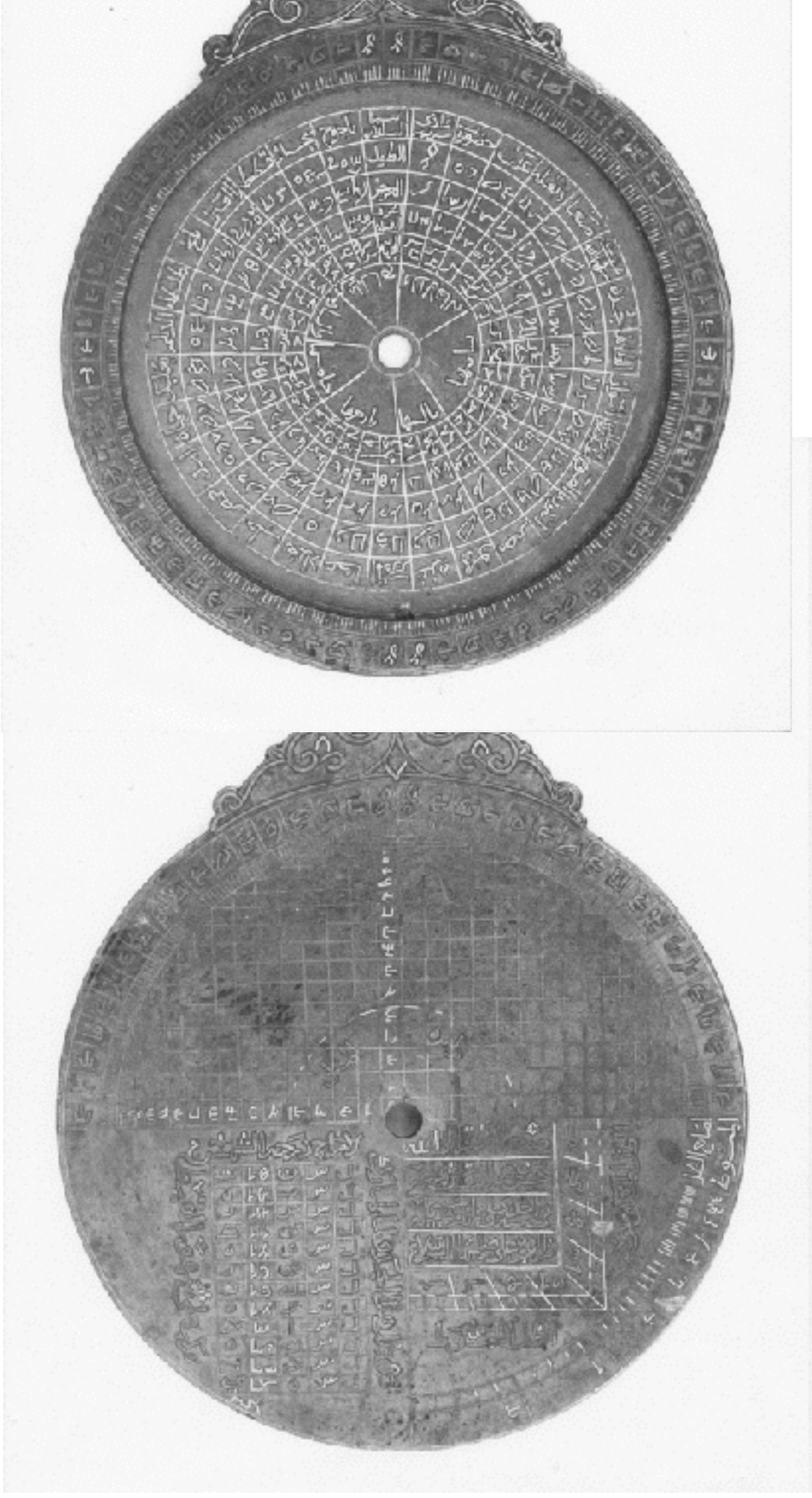
S13



The components of a brass astrolabe found in Egypt by one of Napoleon's scholars, J.-J. Marcel. The lithograph images are of a very high quality, better than most 20th-C photos of astrolabes. The astrolabe is unsigned and undated but is of Andalusī provenance and datable to the 13th or 14th C. One of the leading astronomers in Cairo in the late 13th C, Abū ʿAlī al-Marrākushī, was of Moroccan origin and brought to Cairo aspects of Maghribī and Andalusī astronomy. This astrolabe has never resurfaced.

***Description de l'Égypte*, *É.M.*, II, pl. HH / p. 737. See also Gunther, *Astrolabes of the world*, I, pp. 282-283.**

S14



An astrolabe made in Cairo by al-Ḥasan ibn ʿUmar al-Naqqāsh in 681 H (1282/83). The inscriptions are partly in Arabic and partly in Coptic. The rete or star-map has unusual decorations including endless knots. The mater or main-frame has a table of 30 localities named in Arabic and their *qibla*s in Coptic numerals. The back bears trigonometric grids and calendrical scales.

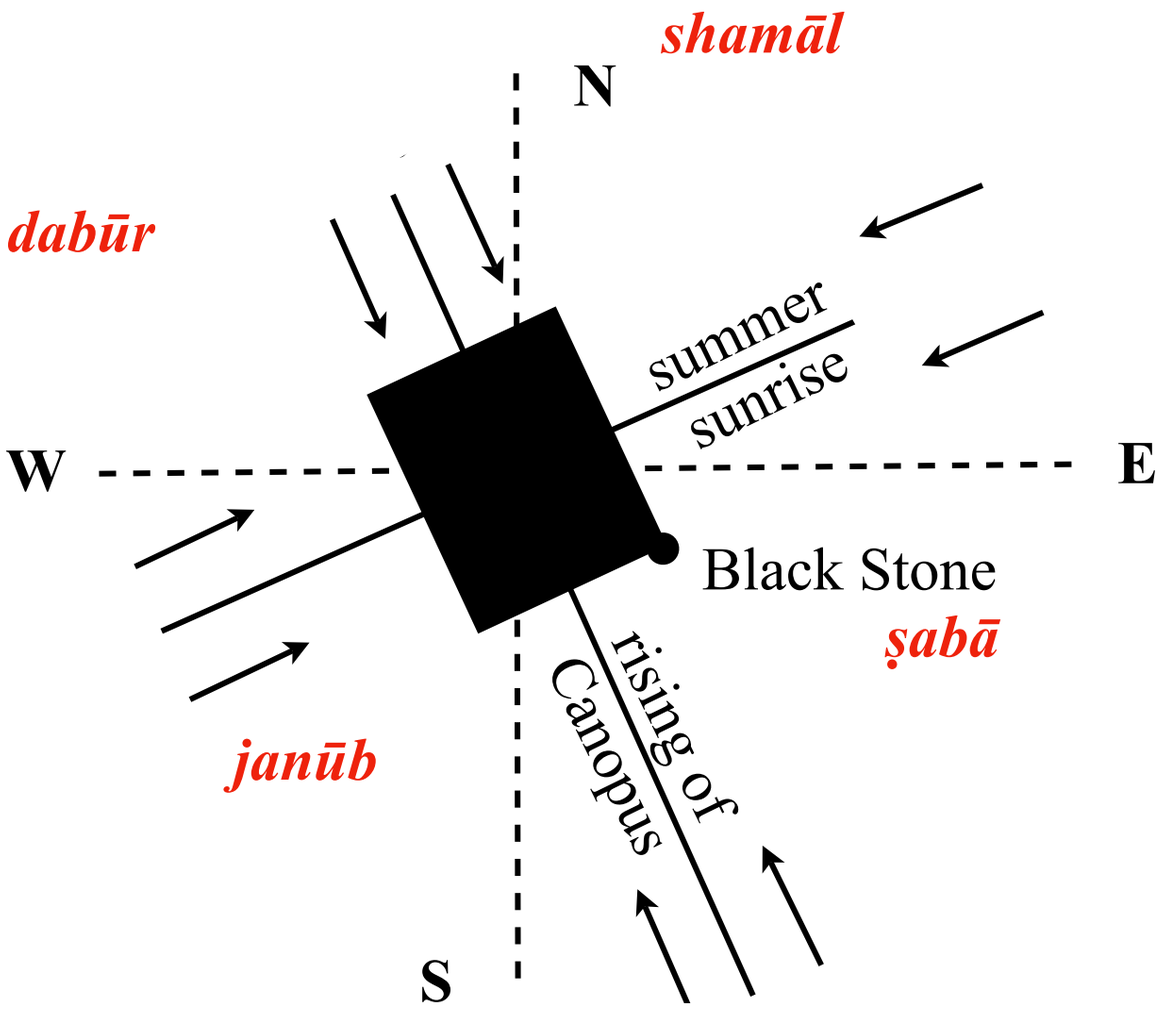
Courtesy of Museum of Turkish and Islamic Archaeology, Istanbul.

T: The *qibla* in medieval Cairo

Note: The early Muslims used the cardinal directions and astronomical horizon phenomena to find the direction toward the Kaʿba, which is itself astronomically aligned. This practice continued even after the introduction of mathematical procedures and geographical data for calculating the direction toward the city of Mecca. Therefore it is not surprising that we sometimes find a palette of different *qibla* directions used for mosque orientations in a given city over the centuries.

Reminder: The <u>modern</u> *qibla* is irrelevant in any discussion of <u>historical</u> architecture. Muslims did not know the modern *qibla* centuries ago. Even though they may have used accurate mathematical procedures they did not have access to modern geographical coordinates.

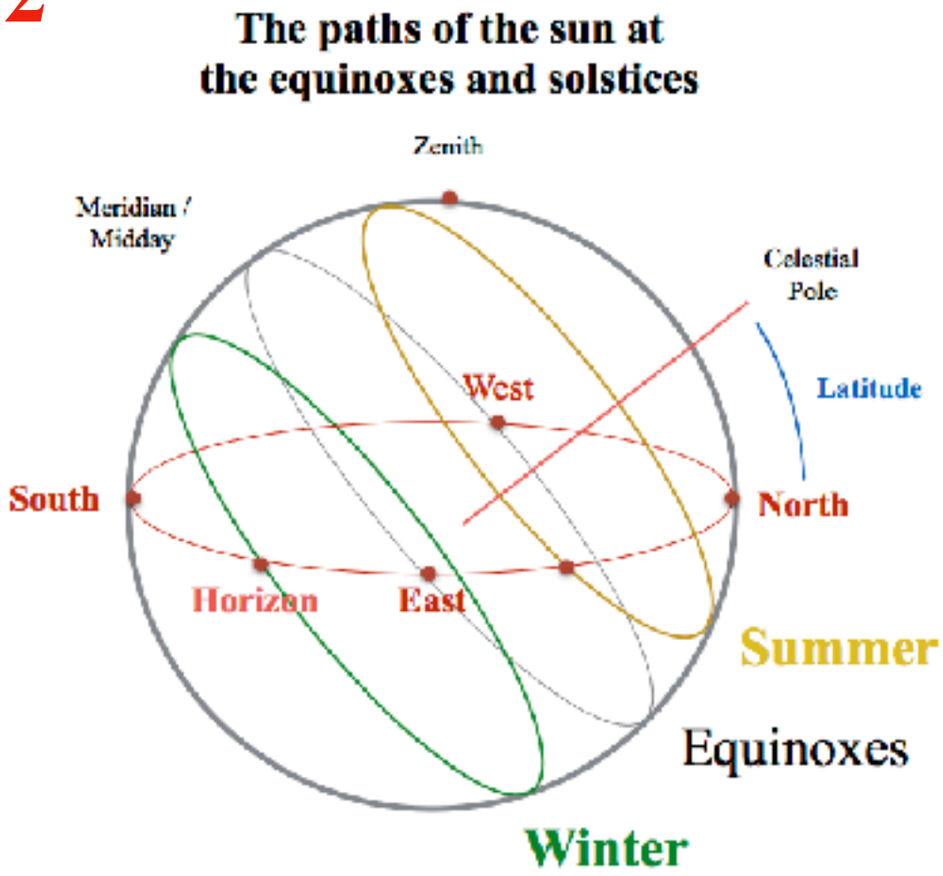
T1

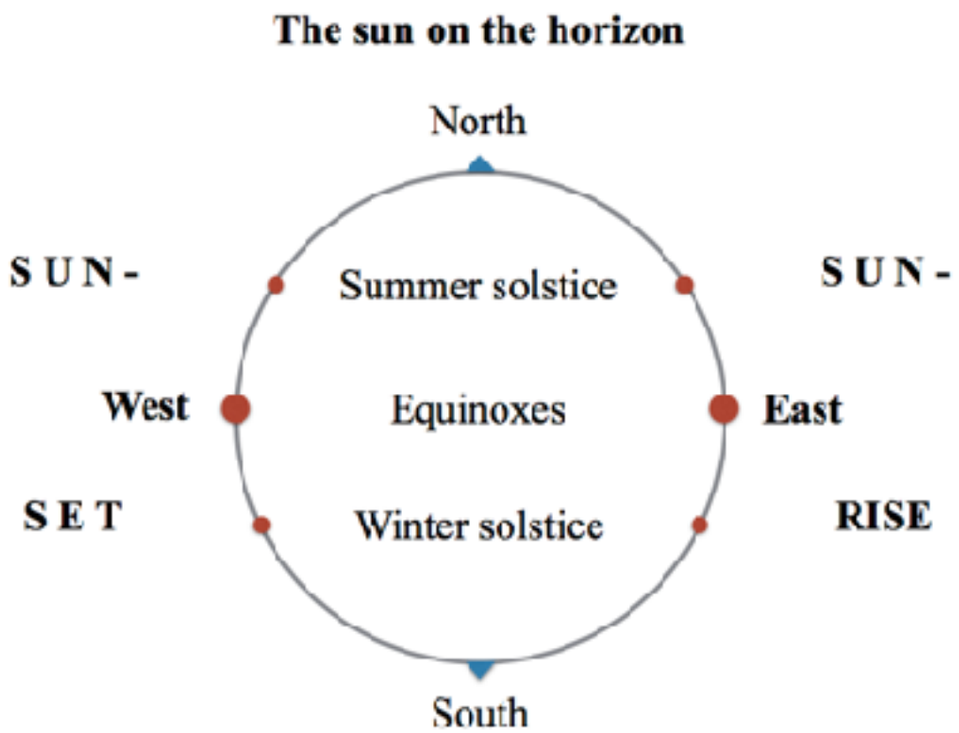


King & Hawkins,
"Orientation of the Kaʿba" (1982);
King, "Makka as centre of the
world" & "Maṭlaʿ (rising points)"
in *Enc. Islam*, 2nd edn., also
"Finding the *qibla* by the sun and
stars – Islamic sacred geography –
50 medieval sources" (2019).

The *qibla* is toward the Kaʿba, not towards Mecca. To find the *qibla* one needs to know first about the Kaʿba. The astronomical orientation of the Kaʿba is mentioned in medieval texts and has been confirmed by satellite images. The corners of the edifice are associated in local medieval folklore with the four 'cardinal' winds, which blow within the quadrants defined by the axes of the Kaʿba. The rising of Canopus, a south indicator, is conveniently perpendicular to summer sunrise at the latitude of Mecca, so the layout is simple. How to face a distant edifice without geographical or mathematical knowledge? It helps to know that different parts of the edifice were associated with different regions. For a start, the corners of the edifice roughly face the cardinal directions and were named after Syria, al-ʿIrāq, the Yemen, and "the West". Over the centuries numerous different schemes were developed relating the *qibla*s of different regions to the astronomical directions one is facing when standing in front of the appropriate segment of the perimeter of the Kaʿba.

T2





The first generations of Muslims in the Hejaz had a sophisticated folk astronomy, a knowledge of the changing sky and its connection to the seasons. (This is partly documented in a book by the 9th-C scholar Ibn Qutayba.) When the Muslims expanded out of the Hejaz they had no mathematical knowledge (or geographical knowledge) to calculate the direction of the Kaʿba in Mecca. Nor did they need to have. They knew that the the Kaʿba was aligned in a certain way. Once away from Mecca they could face the sides or corners of the Kaʿba by standing in an appropriate astronomical direction. Such directions were used throughout Antiquity in the Mediterranean regions and in Arabia, notably in Petra, where cardinal and solstitial alignments were very frequently used.

The diagram on the left shows the daily motion of the sun throughout the year, featuring the 'day-circles' at the equinoxes and solstices. The diagram on the right shows the sun on the horizon. The sun rises in the east between winter sunrise around east south-east and summer sunrise around east north-east. It sets in the west between winter sunset around west south-west and summer sunrise around west north-west. The rising and setting amplitude of the sun – the distance of sunrise from the east point and that of sunset from the west point is called the solar rising amplitude and varies as a function of terrestrial latitude.

T3

A diagram showing the relative positions of the major Mamluk cities with respect to the perimeter of the astronomically-aligned Kaʿba. Taken from the most detailed known legal treatise on the *qibla*, authored by the 12th-C Egyptian legal scholar al-Dimyāṭī. See also Pl. U9.

MS Oxford Bodleian Hunt. 592, fol. 88v, courtesy of the Bodleian Library.

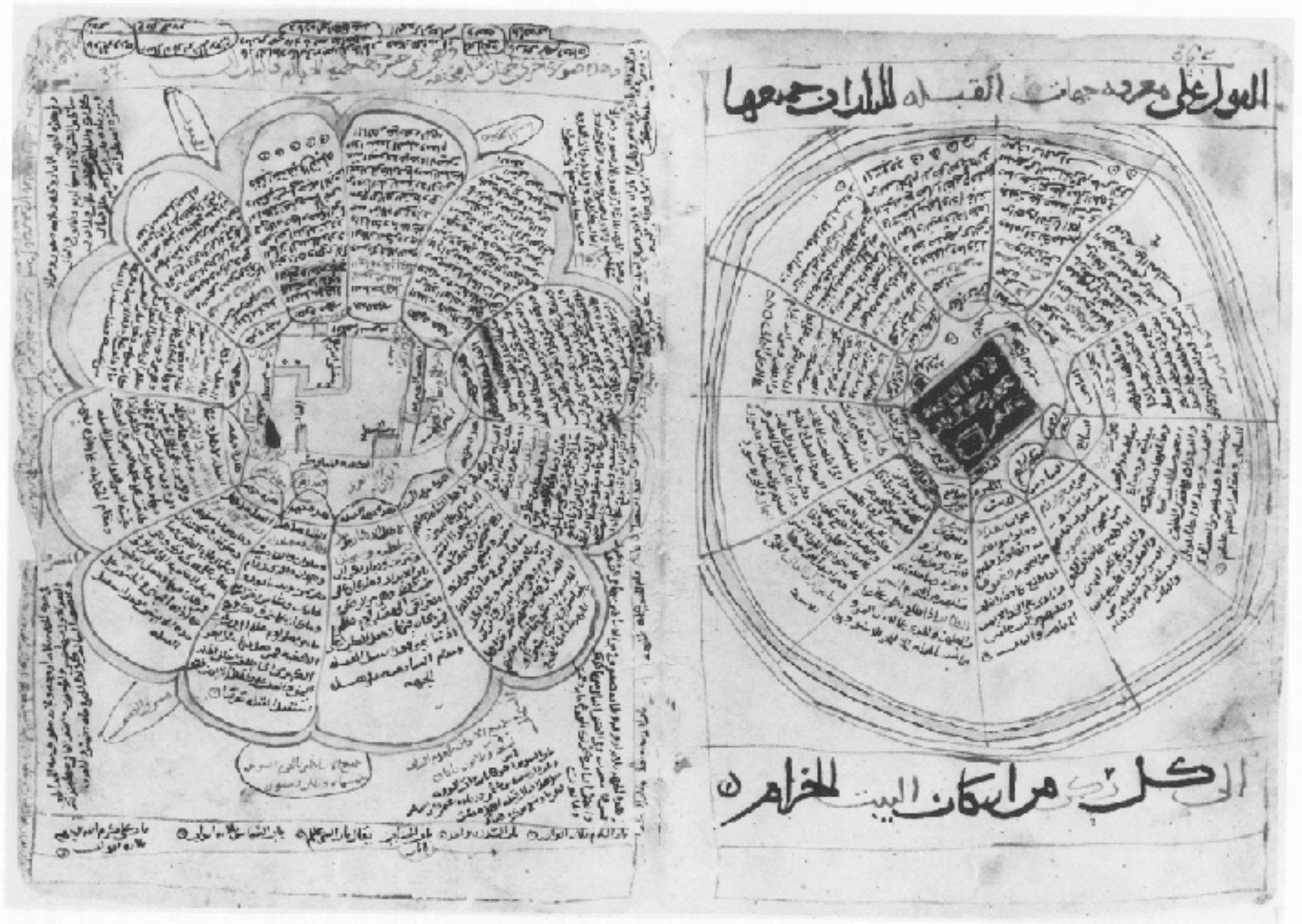
T4

A scheme of sacred geography showing eight regions of the world associated with segments of the perimeter of the astronomically-aligned Kaʿba.

MS Paris BnF ar. 2186, fol. 44r, courtesy of the Bibliothèque nationale de France.

The *qibla* of Cairo, as well as of al-Maghrib and al-Andalus, is shown as being toward the NW wall of the Kaʿba, which features the water-pipe (الميزاب , *al-mīzāb*) and the low semi-circular wall (الحجر , *al-ḥijr*).

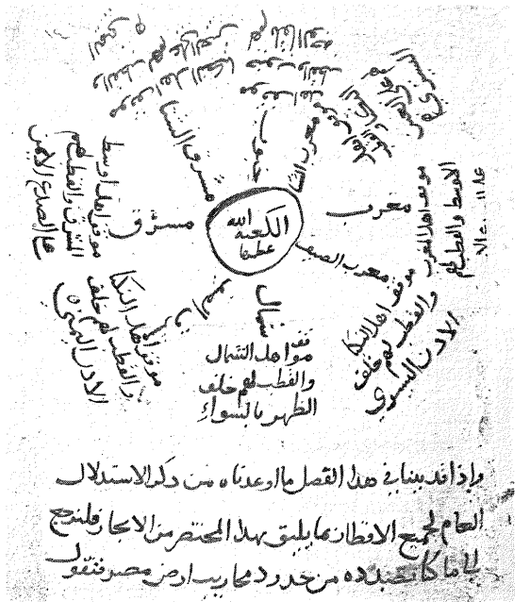
T5

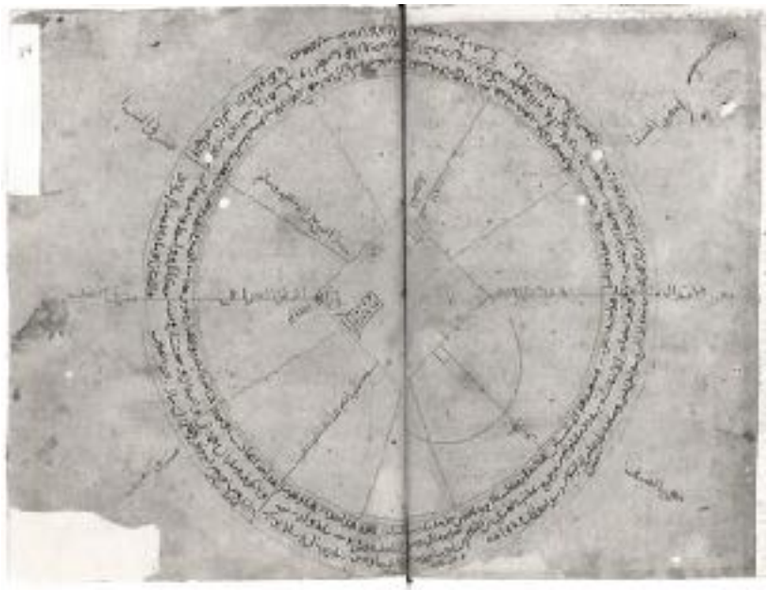


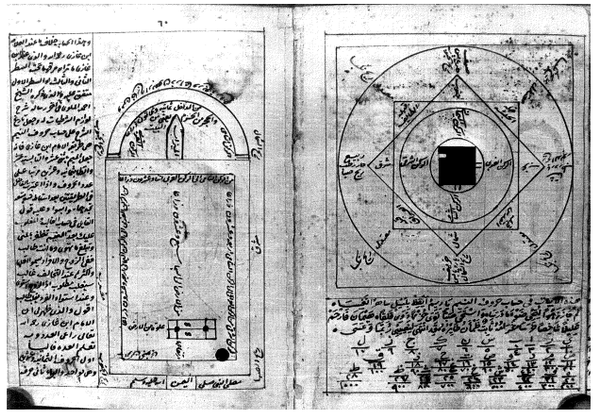
These schemes of sacred geography from 13th-century Yemen contain complex instructions for finding the *qibla* in each region by means of astronomical horizon phenomena. They have been analyzed in Petra Schmidl, *Volkstümliche Astronomie im islamischen Mittelalter* (2007).

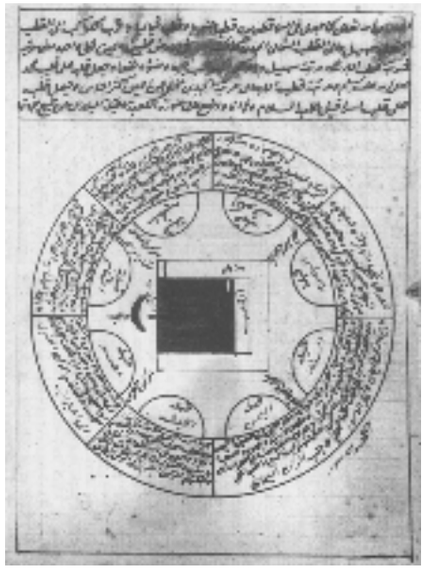
MS Milan Ambrosiana Griffini 37, unfoliated, courtesy of the Biblioteca Ambrosiana.

T6



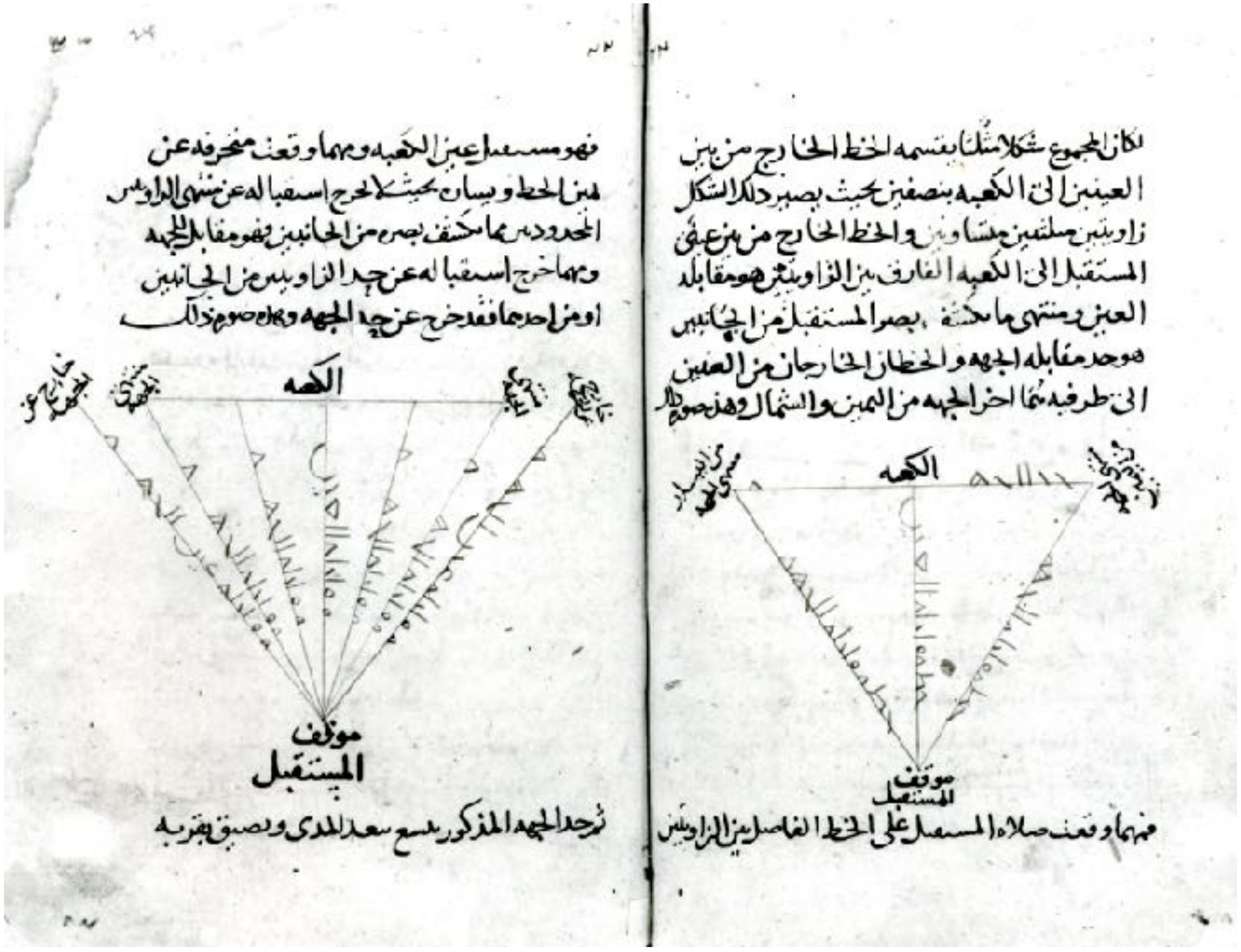






Some 50 medieval sources are known to contain schemes of sacred geography such as these. Twenty different schemes are documented. The number of sectors of the world arranged about the Kaʿba varies from 8 to 72, the most common being 12. The 8-sector scheme on the left and the 13-sector scheme above are due to the same author al-Dimyāṭī .

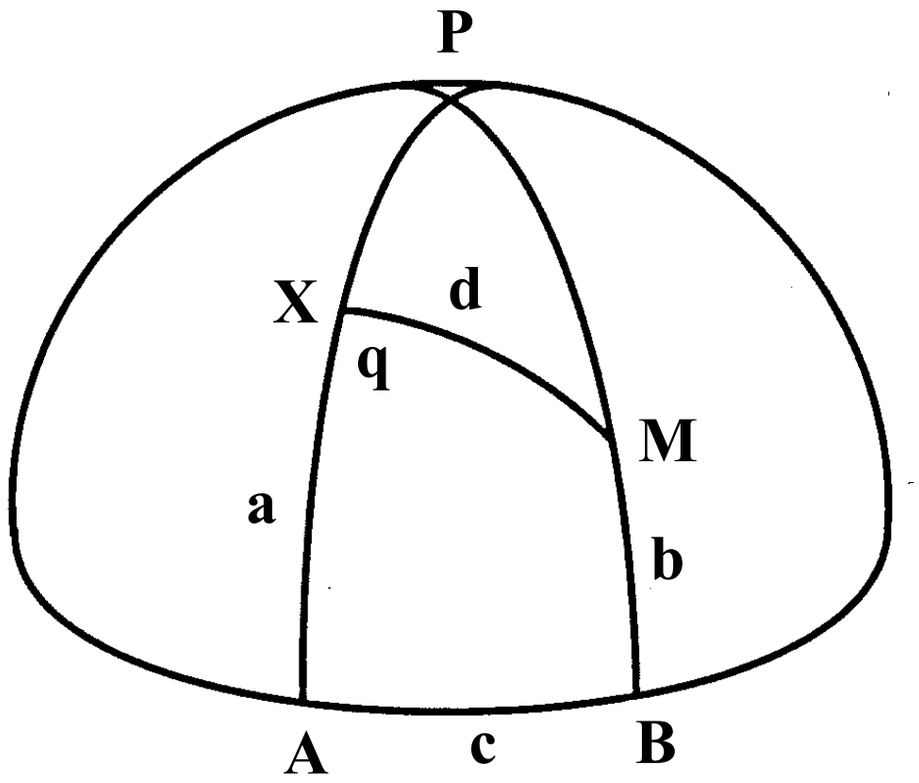
King, “Islamic sacred geography” (2019/2020).



al-Dimyāṭī illustrates the way in which one should ideally stand facing the Kaʿba (right-hand diagram showing concept of عين الكعبة , *ʿayn al-Kaʿba*) but that it is legally acceptable to stand facing a quadrant of the horizon about that optimal direction (left-hand diagram, concept of جهة الكعبة , *jihat al-Kaʿba*).

MS Oxford Bodleian Hunt. 592, fols. 23v-24r, courtesy of the Bodleian Library.

T8

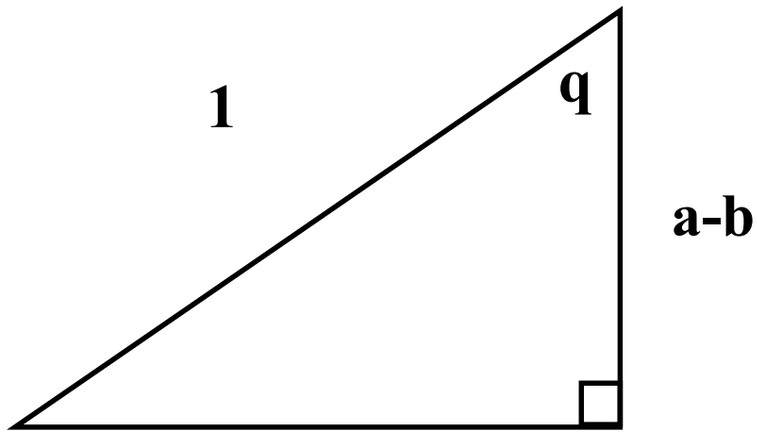


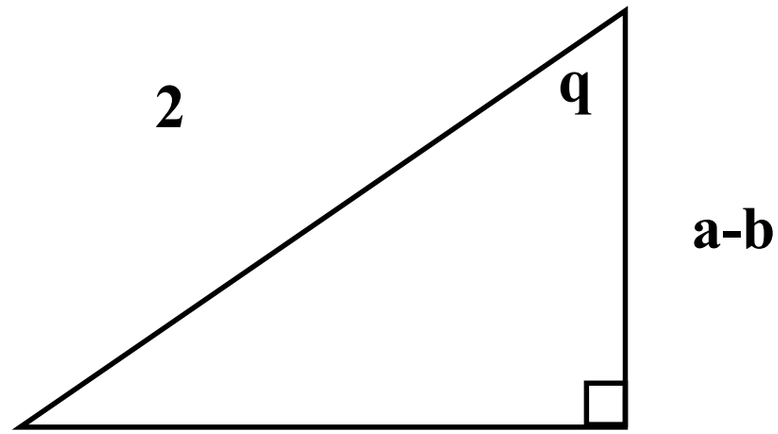
From the 9th century onwards Muslim astronomers were able to calculate the *qibla* for the available geographical coordinates of major localities. It is required to find the direction of any locality to Mecca and also the distance to Mecca. Here X is any locality and M represents Mecca. P is the North Pole and PXA and PMB are the meridians (north-south lines) of X and M, where A and B are on the celestial equator. The latitude at X is measured by arc XA = a (variable) and the latitude at M is measured by arc MB = b (fixed). The longitude difference between X and M is measured by arc AB = c (variable) on the equator. The direction to Mecca, that is, the *qibla*, is represented by angle MXA = q and the distance to Mecca, measured by the arc XM = d. Then the modern formulae for the *qibla* q (measured from the local meridian) and the distance d to Mecca are:

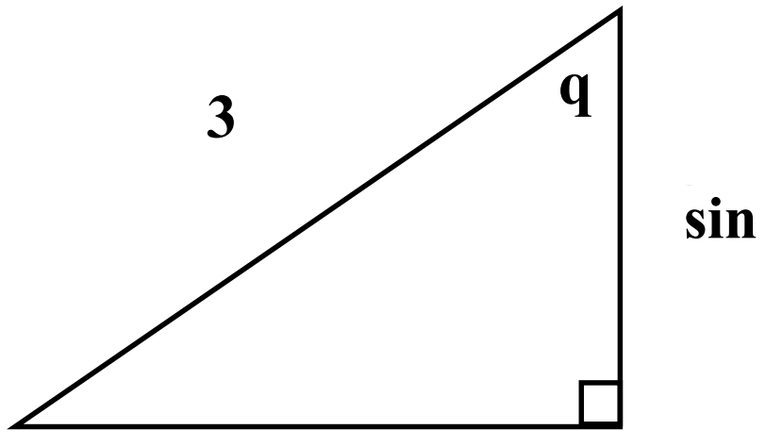
q(a,c) = arc cot { [sin a cos c - cos a tan b] / sin c } & d(a,c) = arc sin { sin c cos b / sin q } .

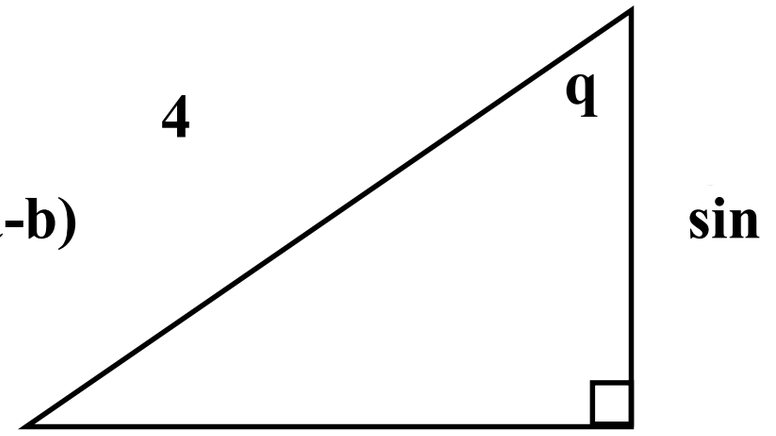
In medieval times, equivalent formulae to these were developed mainly by projecting the sphere onto a plane and solving the problem by plane trigonometry. Alternatively, the solutions could be derived by spherical trigonometry. Muslim astronomers were masters of both plane and spherical trigonometry. The earliest solutions were approximate and less complicated than those given above. However, when it came to laying out mosques, the astronomers were not always consulted.

T9





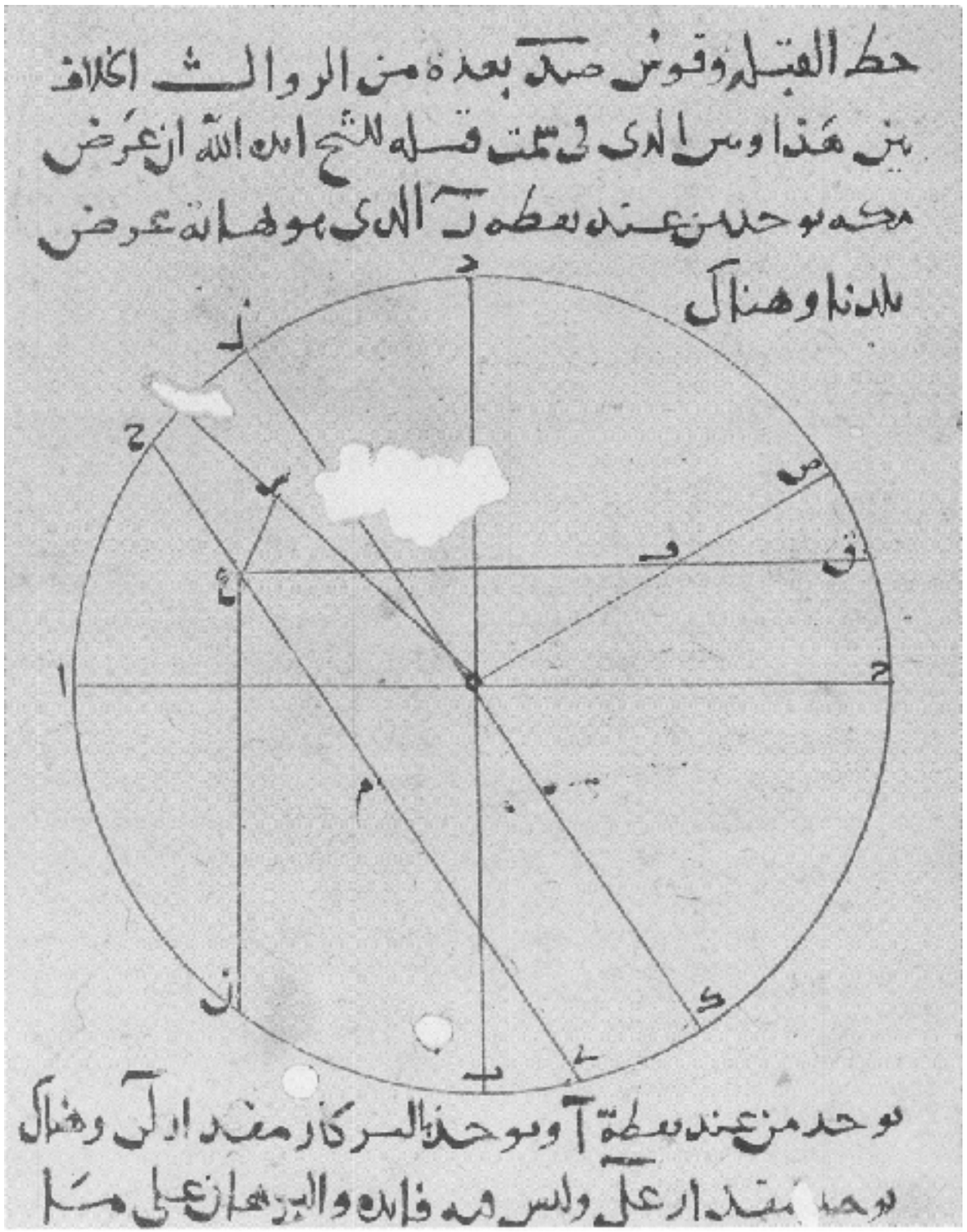




Various approximate solutions to the *qibla* problem were developed during C8-9. They give the impression of having been developed by cartographical considerations.

King, "The earliest Islamic mathematical methods and tables for finding the direction of Mecca" (1986).

T10



HISTORIA MATHEMATICA 1 (1974), 3-11

A LETTER OF AL-BĪRŪNĪ
ḤABASH AL-ḤĀSIB'S ANALEMMA FOR THE QIBLA

BY E.S. KENNEDY, AMERICAN UNIV. OF BEIRUT
AND BROWN UNIVERSITY
AND YUSUF 'ID, DEBAYYAH CAMP, LEBANON

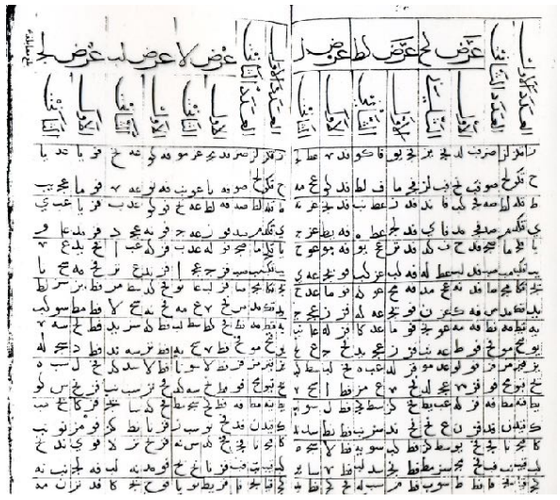
SUMMARIES

Given the geographical coordinates of two points on the earth's surface, a graphical construction is described for determining the azimuth of the one locality with respect to the other. The method is due to a ninth-century astronomer of Baghdad, transmitted in a short Arabic manuscript reproduced here, with an English translation. A proof and commentary have been added by the present authors.

In Baghdad *ca.* 850 the leading astronomer Ḥabash al-Ḥāsib wrote a treatise on the determination of the *qibla* by means of a geometrical construction called the analemma. This brilliant solution was published in 1974 by the American historian of Islamic astronomy, Prof. E. S. Kennedy, together with his Palestinian student, Yusuf 'Id.

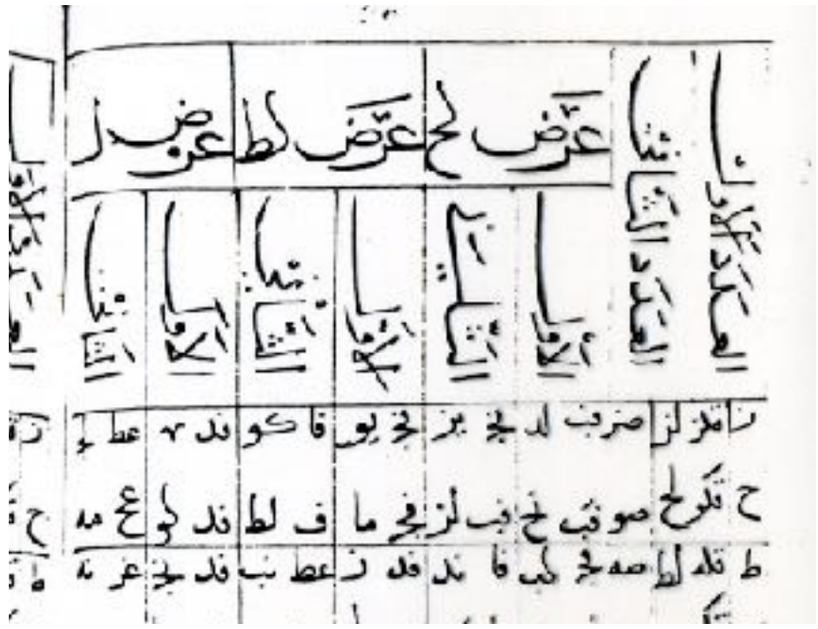
MS Leiden Universiteitsbibliotheek Or. 168.

T11



Longitude of Mecca = 67°

ΔL		45°	46°
60°	7° 127°	85; 3	84;21 +1
59°	8 126	84;18	83;33
58°	9 125	83;32	82;46
57°	10 124	82;46 +1	81;59
56°	11 123	81;59	81;11
55°	12 122	81;11	80;22
...	13 121	80;23	79;33
	14 120	79;35 +1	78;43
	15 119	78;46 +1	77;53
	16 118	77;56 +1	77; 3 +2
	17 117	77; 4	76;11 +2
	18 116	76;12	75;17

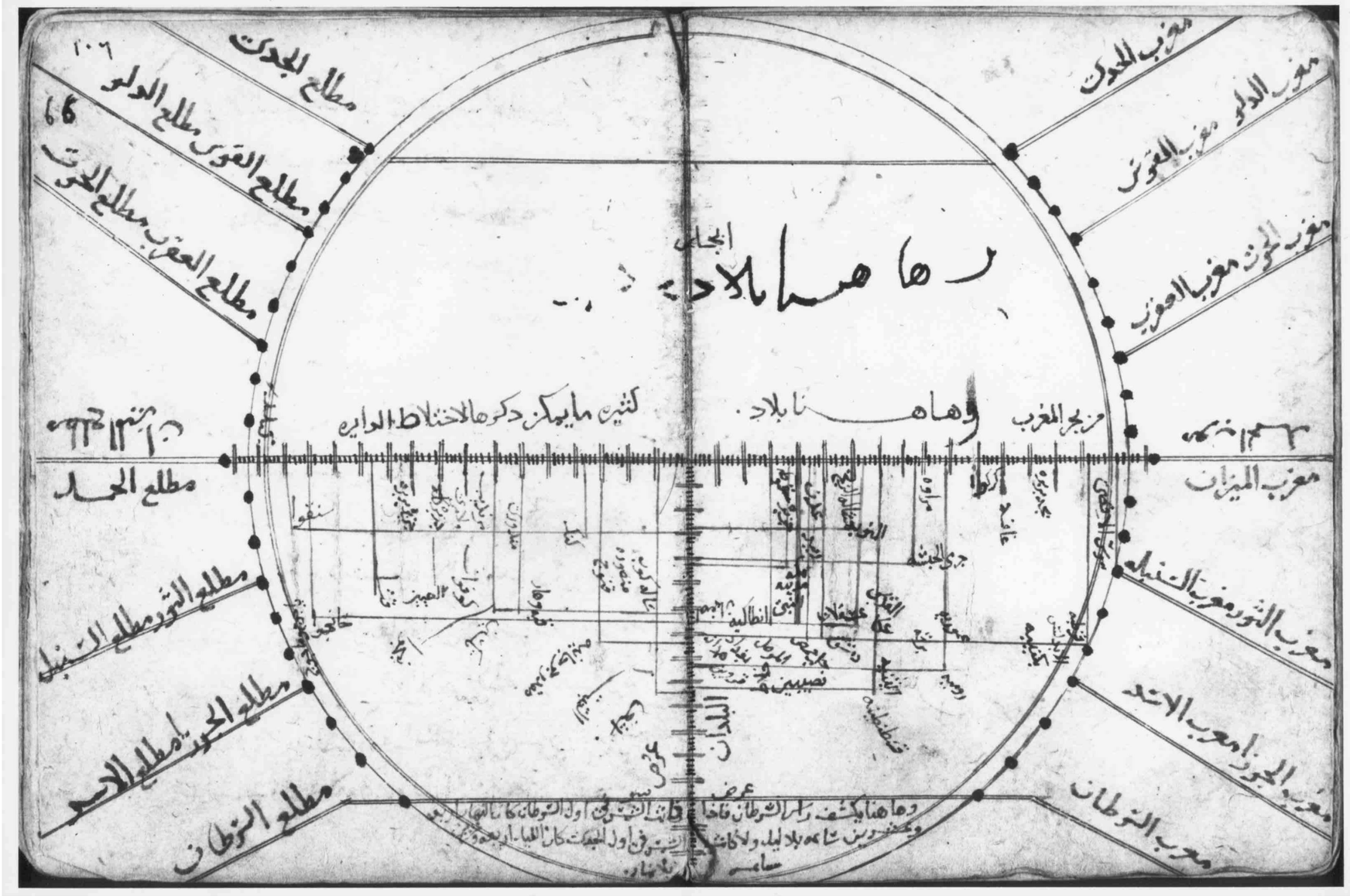


“Tables of the hour-angle and the operations (of timekeeping) by night and day for latitude 33;30°, calculated by *al-shaykh* Shams al-Dīn ... al-Khalīlī, muezzin at the Umayyad Mosque, and a table for finding the *qibla*, followed by a universal table that can be used (to solve all the problems of spherical astronomy) for any latitude .”

The work of al-Khalīlī of Damascus (*ca.* 1365) represents the culmination of Islamic spherical astronomy. (Nothing like it was produced in Europe before the early modern period.) Here we see the title folio of his *magnum opus*, together with extracts from his universal *qibla*-table. Values of the *qibla* are given for each degree of longitude and latitude and are generally accurate to the nearest minute.

MS Paris BnF ar. 2558, courtesy of the Bibliothèque nationale de France, fols. 55v-56r.

T12

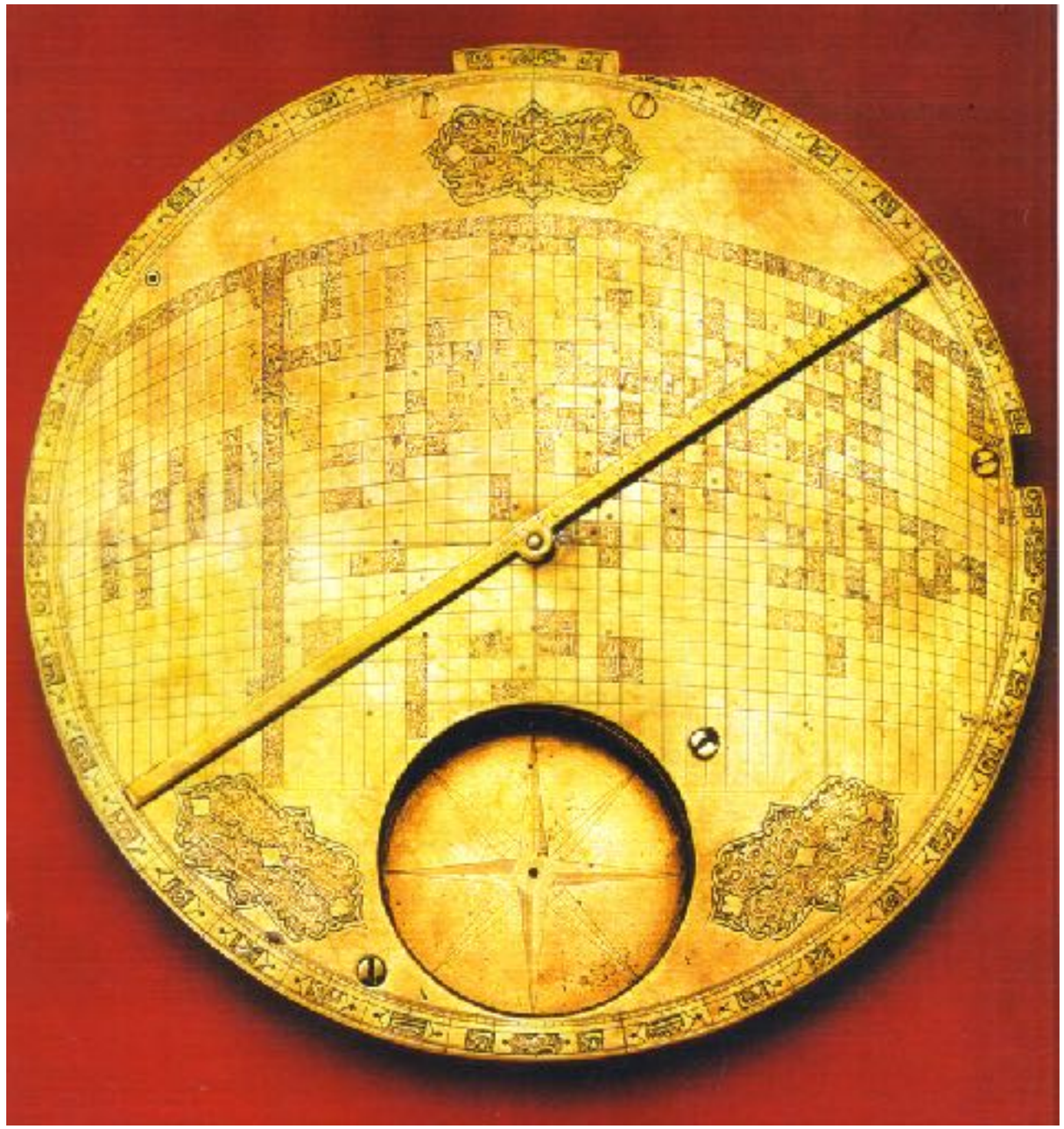


A map of the world combining mathematical geography (localities plotted according to their coordinates) with folk geography (directions defined in terms of the rising and setting of the sun). The map occurs in a copy of an Egyptian treatise on folk astronomy compiled *ca*. 1210, and the coordinates go back to a map of al-Khāzinī (*ca*. 1125) based on the geographical table of the great scientific polymath al-Bīrūnī (*ca*. 1025).

MS Princeton Yahuda 4657, fols. 65v-66r, courtesy of Princeton University Library.

T13

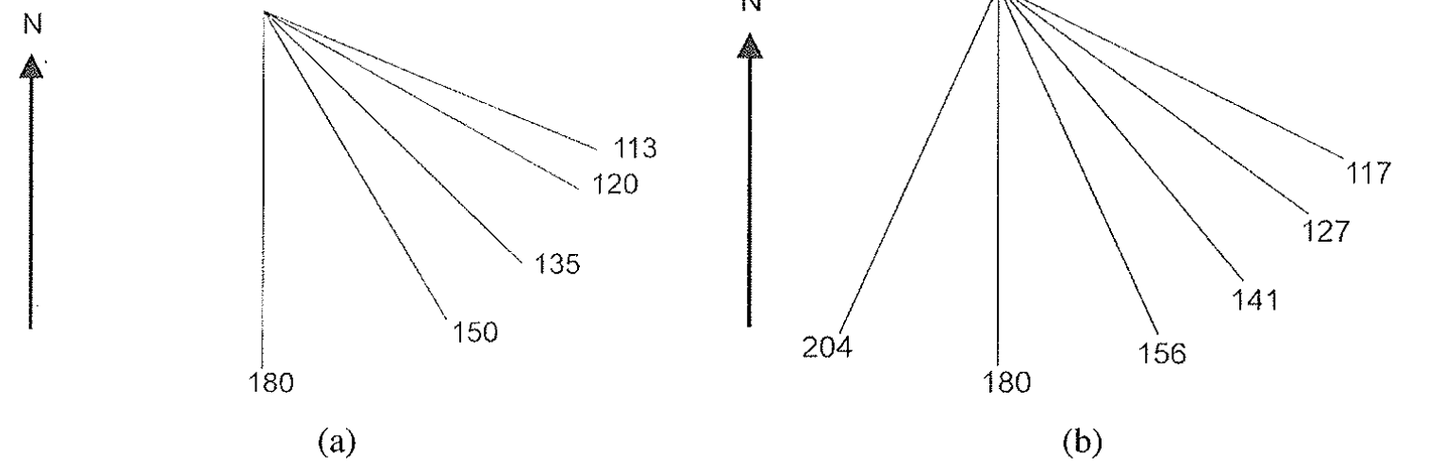
So much for the determination of the *qibla* by the simple methods of folk astronomy. … …



King, *World-Maps centred on Mecca* (1999).

We conclude these objects with a splendid example of the culmination of Islamic mathematical cartography. Discovered only in 1989, this brass disc bears a highly sophisticated cartographical grid which is centred on Mecca. The diametral rule enables the user to point to any of 150 localities between al-Andalus and China that are shown on the grid and to simply read off the *qibla* on the circumferential scale and the distance to Mecca on the rule itself. The instrument is from late-17th-century Isfahan and two similar examples have been found more recently. The positions of the localities have been taken from an enormous geographical table prepared near Samarqand in the early 15th century. The mathematical theory underlying the grid was known already in 10th-century Baghdad and in 11th-century Isfahan. Such devices appear to have been known only in Iran. When they first appeared it was thought by some that they "must have" been inspired by Western science, but this was easily disproved. A map of this kind was first published in Europe *ca*. 1910 by the German historian of Islamic science Carl Schoy, who was the first to investigate medieval *qibla* methods and who wrote the article "Qibla" in the first edition of the *Encyclopaedia of Islam*.

T14

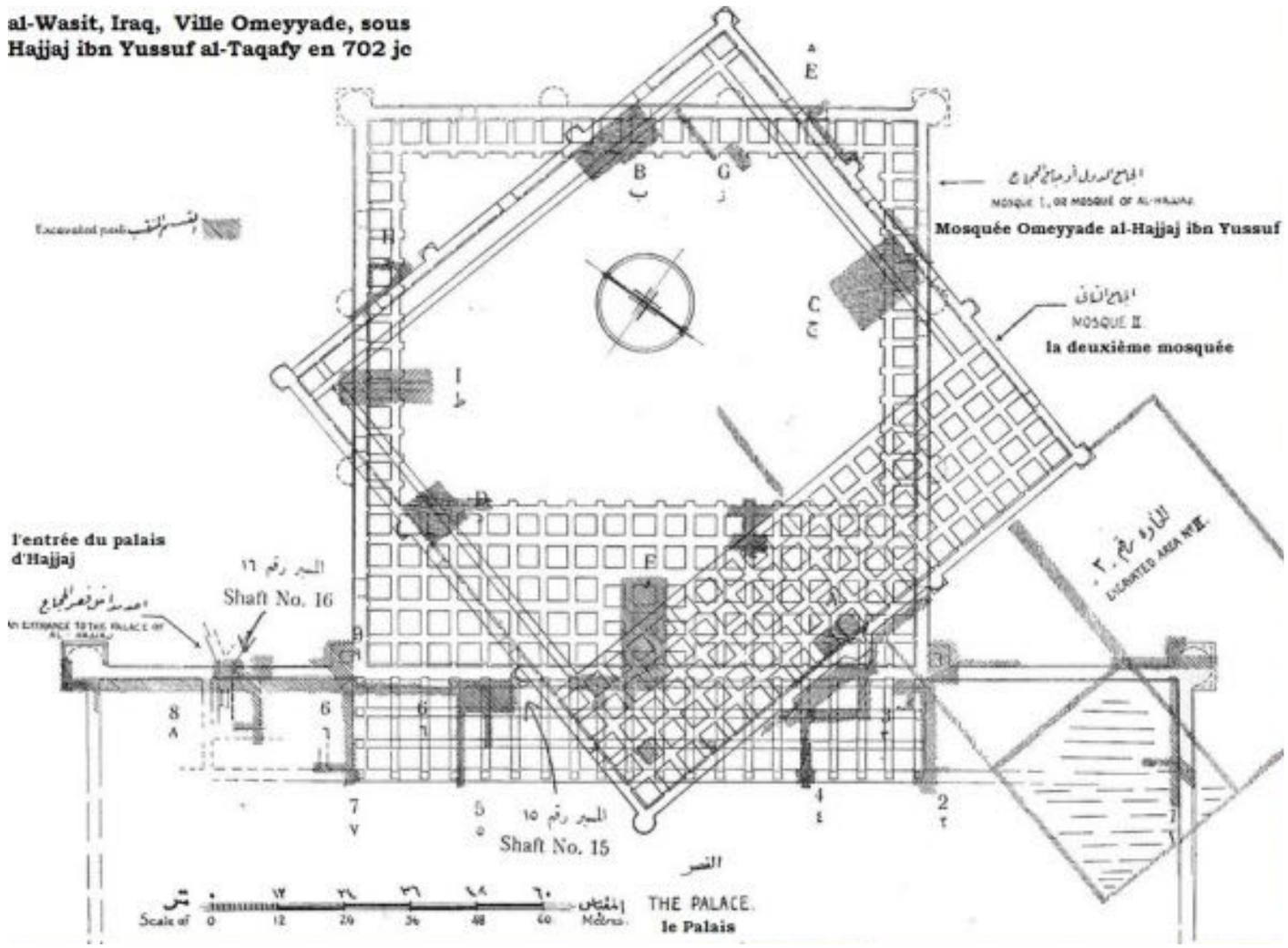


Various *qibla*-directions and mosque orientations accepted in medieval cities of (a) Córdoba, (b) Cairo, and (c) Samarqand. These include astronomical directions, cardinal and solstitial, and *qibla*s determined by mathematical procedures.

To unravel all this from mosque orientations alone would be impossible. Fortunately, we have medieval texts which explain it all, يعني .

In Córdoba there is no accurately-computed *qibla* attested, only one derived by an approximate formula (113°), which competed with winter sunrise (120°). The striking orientation of the Grand Mosque (150°) results from the street-plan of the Roman suburb where it was built, and it is happily 'parallel' to the main axis of the Kaʿba. In the case of Cairo, the first mosque was oriented due east (90°) then changed to "the *qibla* of the Companions of the Prophet" at winter sunrise (117°), and in the 10th century the *qibla* of the astronomers (127°) started to become popular. In some suburbs any direction between the rising and setting of the star Canopus (156°/204°), favoured as a south indicator, was used. In Samarqand the *qibla* of the Companions was toward winter sunset (240°) but the *qibla* of the Shāfiʿī legal school was due south (since the Prophet had prayed due south in Medina) and that of the Ḥanafī legal school was due west (since the road to Mecca left Samarqand in a westerly direction). For the situation in Cairo see Pl. U6 below.

T15



Plan by the Iraqi architect Fuad Safar published in 1945 after the 1936-42 excavations.

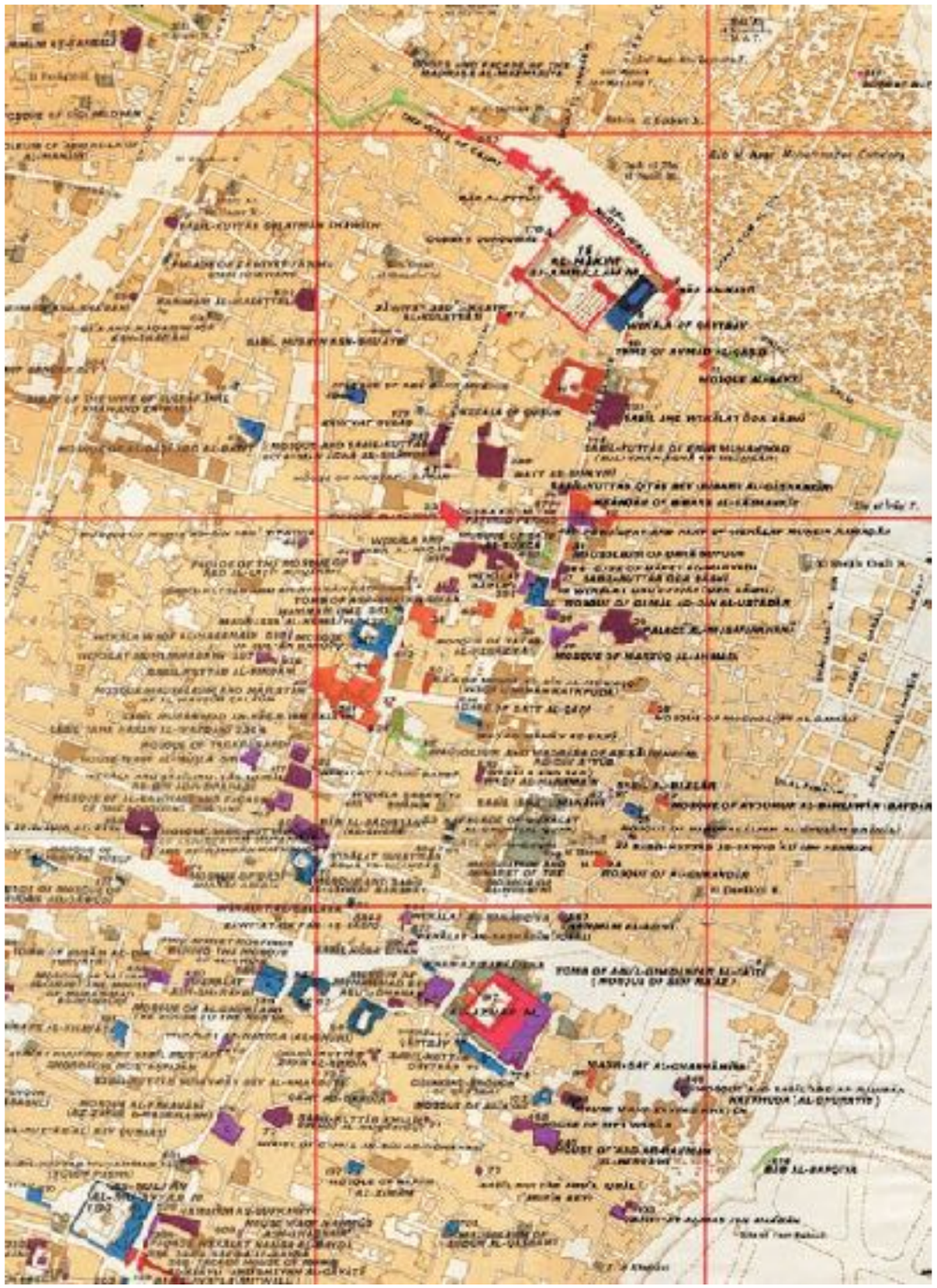
The mosque that tells it all. Built at Wāsiṭ in the province of al-ʿIrāq around the year 709, it was oriented in a deliberate non-cardinal direction. About four centuries later, the mosque was demolished and rebuilt in a quite different non-cardinal direction, more reasonable, one might think, for the *qibla* at Wāsiṭ.
The orientation of the first mosque has has caused investigators some serious trouble. Creswell reasonably thought that the mosque was facing Jerusalem; Cook & Crone made the unfortunate suggestion that it was facing some imagined Hagaritic shrine in N.W. Arabia; Gibson made the ridiculous claim that it was intentionally facing precisely between the modern directions of Petra and Mecca. In fact, the first mosque faces winter sunrise, which is an attested early *qibla* for al-ʿIrāq. The second mosque faces a direction calculated using an exact formula and the available geographical coordinates. The modern *qibla* is irrelevant.

U: The lay-out of medieval Cairo, a city facing the Kaʿba

“I see that the love of air has turned
(the *bādahanj*) away from the *qibla* of Islam”.

The poet al-Qīrāṭī *ca*. 1350

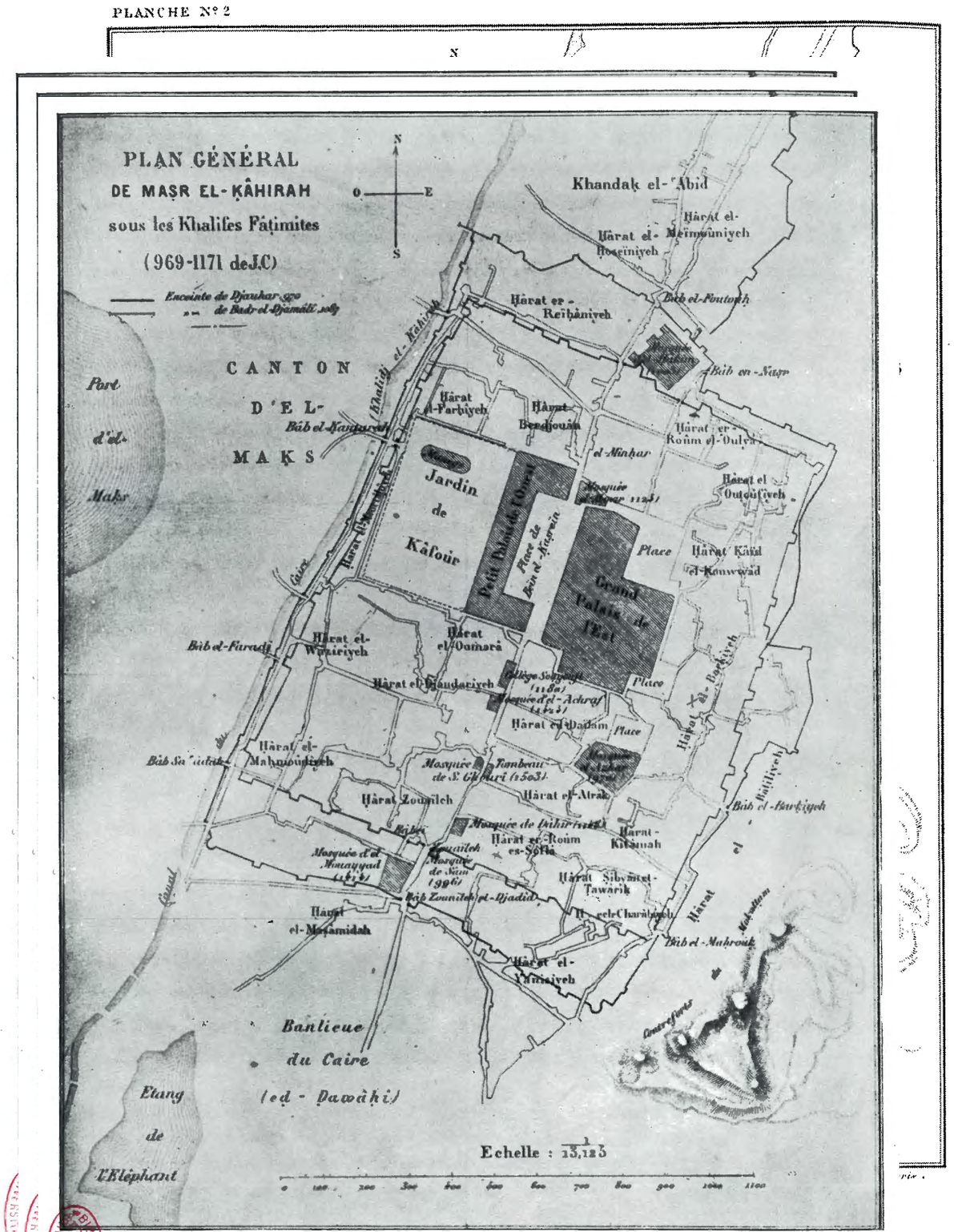
U1



On this 1950 plan of the historical monuments of central Cairo we can still discern parts of the roughly orthogonal street layout of the Fatimid city, whose minor axis faces the *qibla* of the Companions of the Prophet (117°). The Mosques of al-Azhar and al-Ḥākim at each end of the main axis are at a gentle 10° angle to this because they were laid out in the *qibla* computed by the Fatimid astronomer Ibn Yūnus (127°).

See the maps in the article "al-Ḳāhira" in *Enc. Islam*, 2nd end., by J. Michael Rogers.

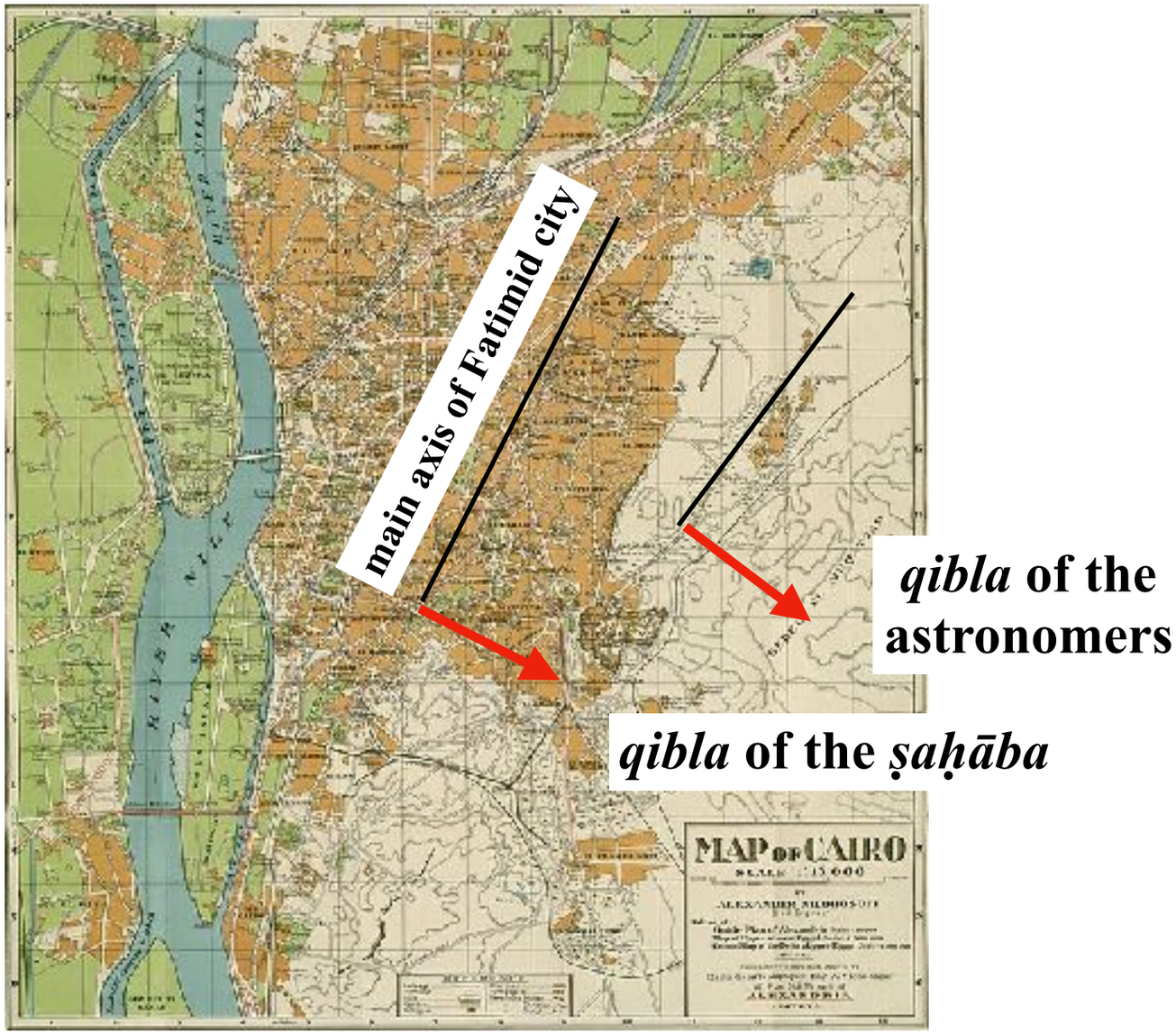
U2



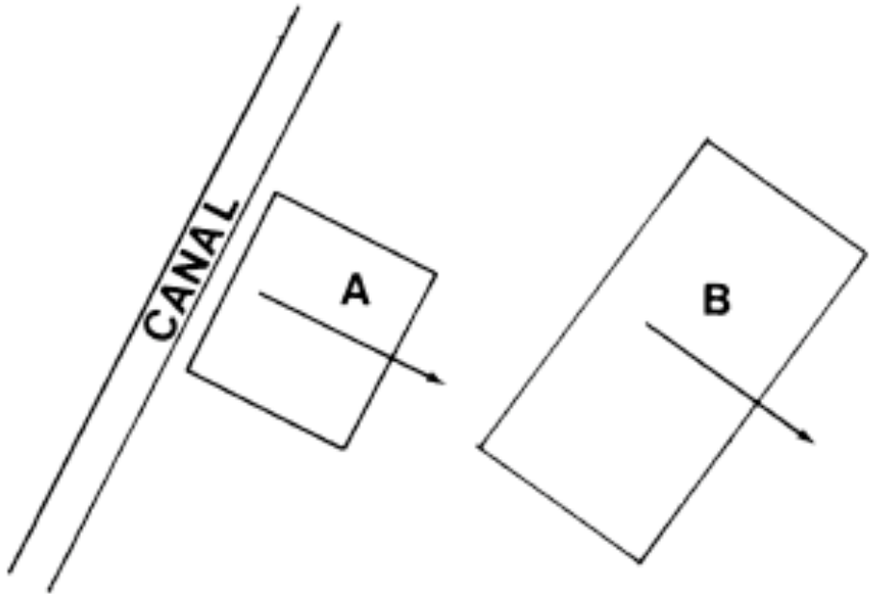
Plan général de la ville fatimide du Caire, d'après Ravaisse.

A reconstruction of the plan of Fatimid Cairo by Paul Ravaïsse (1860-1929), historian and orientalist. The main axis of the city is not only parallel to the Canal on the left but is perpendicular to the *qibla* of the Companions of the Prophet, namely, toward winter sunrise. Both the al-Azhar and al-Ḥākim Mosques are inclined to the minor axis by 10°, facing the *qibla* of Ibn Yūnus.

Edmond Pauty, *Les palais et les maisons d'époque musulmane, au Caire* (1933).



A map of Cairo by Alexander Nicohosoff, Alexandria, 1933.
The principal axes of the Fatimid city at 27° E of N and
the Mamluk City of the Dead at 37° E of N are still discernible.
These related to the *qibla* of the Companions at 27° S of E (117°)
and the *qibla* of the astronomers at 37° S of E (127°).
(The modern *qibla* is irrelevant for any investigation of the medieval city.)

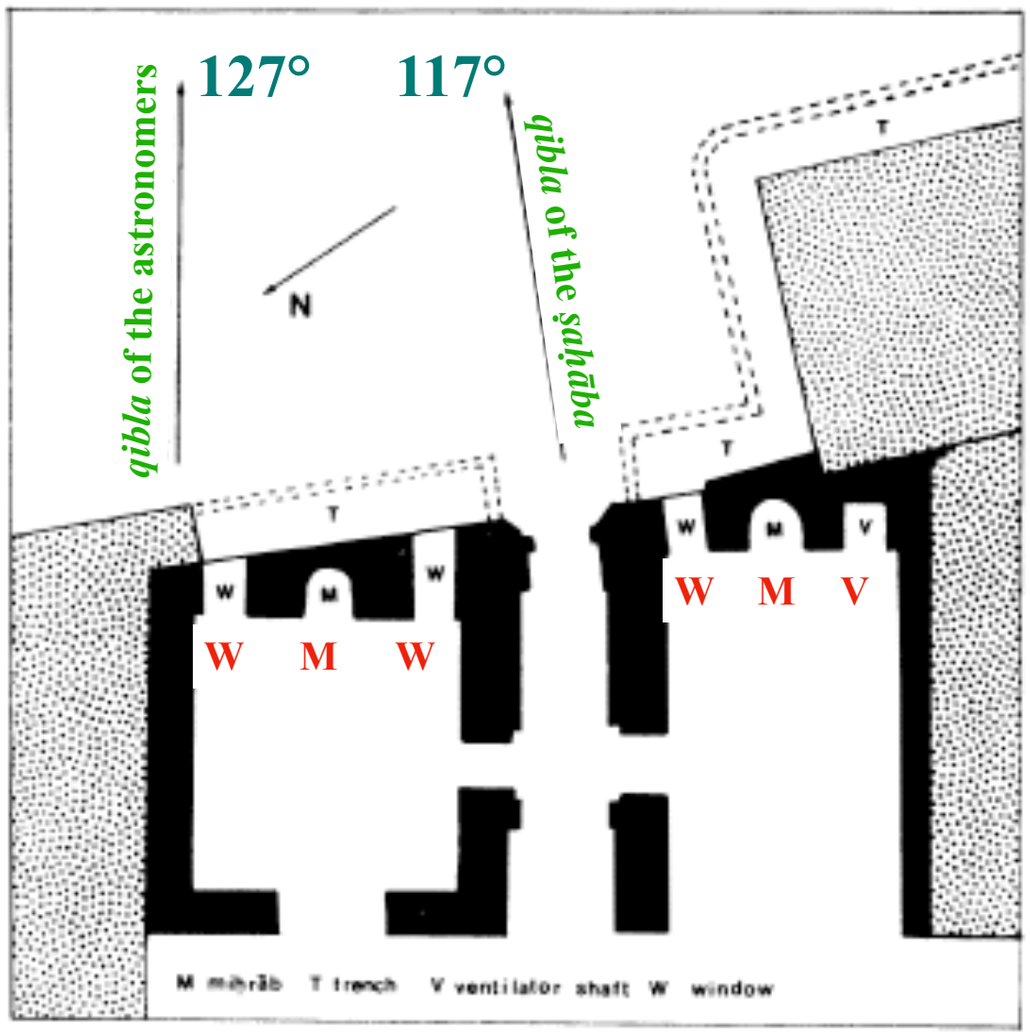


The three main orientations of medieval Cairene architecture. The orthogonal street-plan of the Fatimid city was founded in 969 alongside the Red Sea Canal (A), which at that point was fortuitously perpendicular to the *qibla* of the Companions. The Mamluk city of the Dead (B) was laid out with its axis perpendicular in the *qibla* of the astronomers. The suburb of al-Qarāfa (C) was essentially oriented towards the south, as defined by the rising of Canopus.

Source: King, "Architecture and astronomy" (1984), p. 118.

U5

Sketch of part of the complex – madrasa and mausoleum – of Sultan al-Nāṣir Muḥammad (1295) on the main thoroughfare of medieval Cairo.



The outside wall of the tomb (left) and madrasa (right) is aligned with the main street plan and is thus perpendicular to the *qiblat al-ṣaḥāba*. The façade is not aligned with the street *per se* but rather with the axis of the city. The internal orientation of the various parts of the complex is in the mathematically-determined *qibla*. Thus, for example, the outside and the inside of the wall of the façade are inclined to each other at 10°, which is the difference between the two *qibla*s. This is most clearly visible at the windows W.

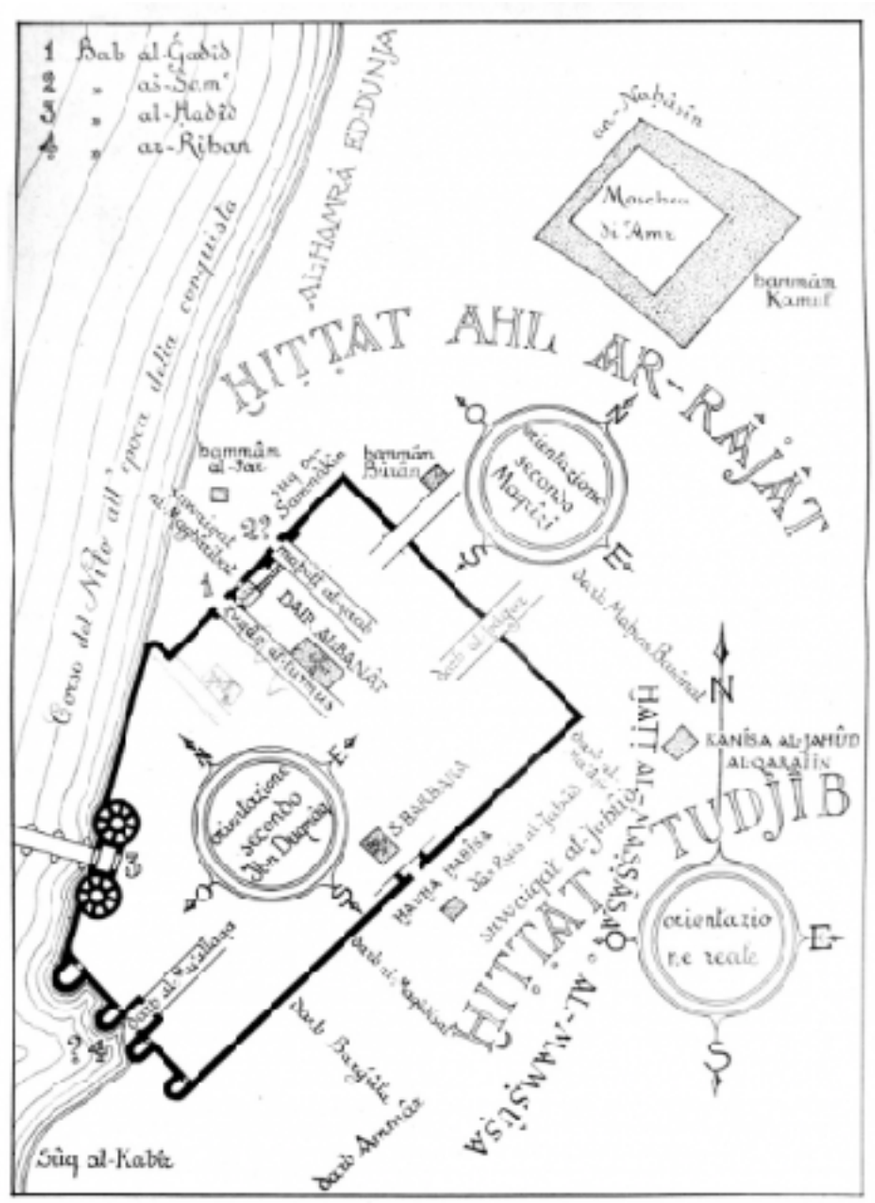
A ventilation-shaft V is to be found next to the *miḥrāb* M in the madrasa; the shaft is oriented in the *qibla* of the astronomers, and presumably the wind-catcher which once adorned the top of the shaft would have been skew to the shaft and aligned with the outside wall of the madrasa.

King, "Architecture and astronomy" (1984), p. 118, after Creswell, *Muslim architecture of Egypt* (1959), II, fig. 137 app. p. 238.

U6

This ingenious plan was prepared (but never published) by the Italian engineer and architect Ugo Monneret de Villard (1881-1954), who spent the period 1921-28 on excavations in Egypt. We see the basically rectangular, but actually irregular pentagonal outline of the Roman / Byzantine Fortress of Babylon (a few km south of modern Cairo), which fell to the Arabs in 640. The west wall borders the Nile, which has long since receded. To the upper right, we see the square outline of the Mosque of ʿAmr , which was built the same year. Both the minor axis of the Fortress and the Mosque are facing roughly south east. But their orientations are 'flexible', for Monneret has relied on information from two authoritative medieval Egyptian historians.

The plan has three directional indicators, each marked with the cardinal directions. But two have been 'adjusted', that is, they have been rotated to graphically present the data. The one between the Fortress and the Mosque is labelled "orientation according to al-Maqrīzī (C15)" and seems to imply that the Mosque is facing due east, which was indeed its first orientation. (Later it was re-oriented to face winter sunrise.) The second inside the Fortress is marked "according to Ibn Duqmāq (C14)" and seems to want to tell us that the Fortress is cardinally aligned, which is not the case. The third, to the lower right, sets (some) things straight for it is labelled"true orientation".



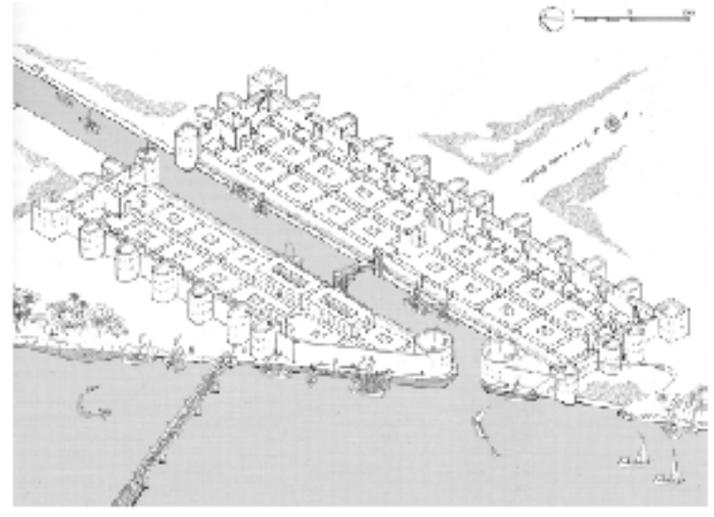
Silvia Armando, "Ugo Monneret de Villard et la découverte de *l'Oriente*" (2013), p. 362, from Biblioteca di Archeologia e Storia dell'Arte Rome), Fonds Monneret, 11 - 1 c 97.

https://wikitravel.org/en/Cairo/Old_Cairo

U7

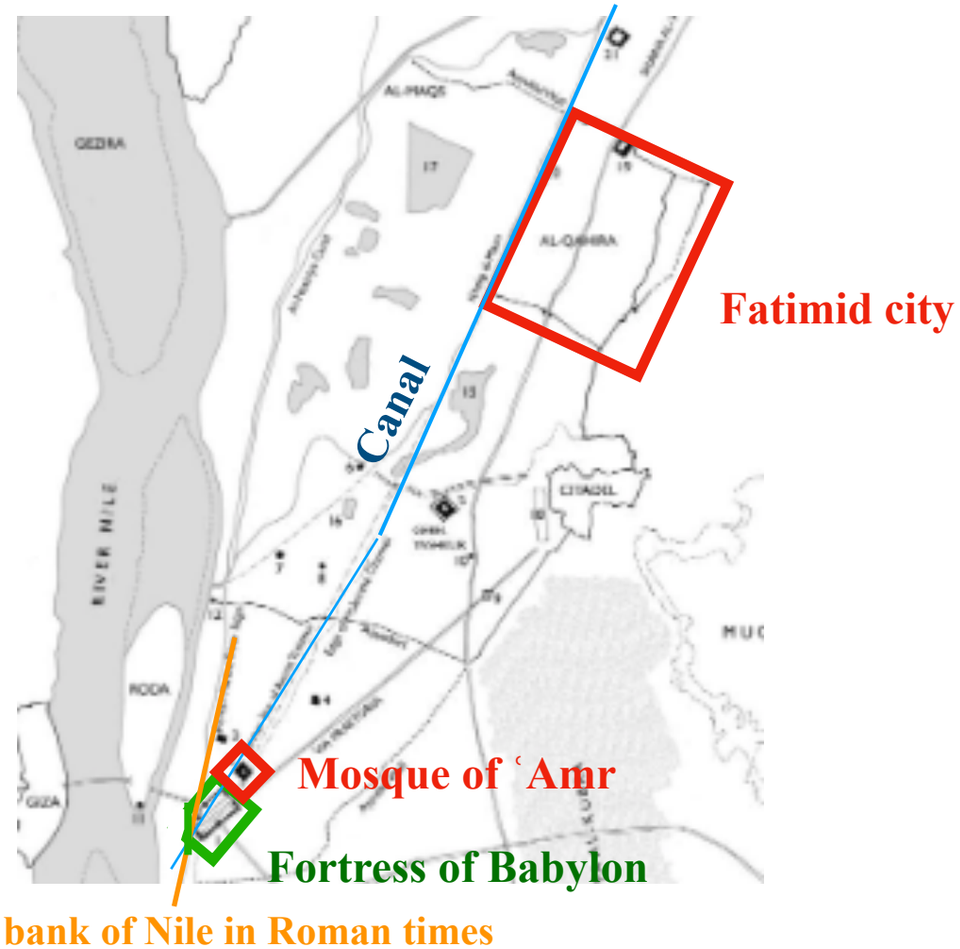
At left, the southern gates of the Fortress of Babylon as recorded *ca*. 1800 in the *Description de l'Égypte* and *ca*. 1840 by the English artist Robert Hay. At right, an axonometric reconstruction of the Fortress of Babylon *ca*. 300 and the entrance to the Red Sea Canal or Amnis Trajanus, which divided the complex evenly into two parts.

The plan to the right and the map below were drawn by Nicholas Warner and are taken from Peter Sheehan, *Babylon of Egypt* (2015).



Axonometric reconstruction of the Roman Fortress of Babylon and the entrance to the Amnis Trajanus c. AD 300. Drawn by Nicholas Warner (Sheehan 2010, fig. 27)

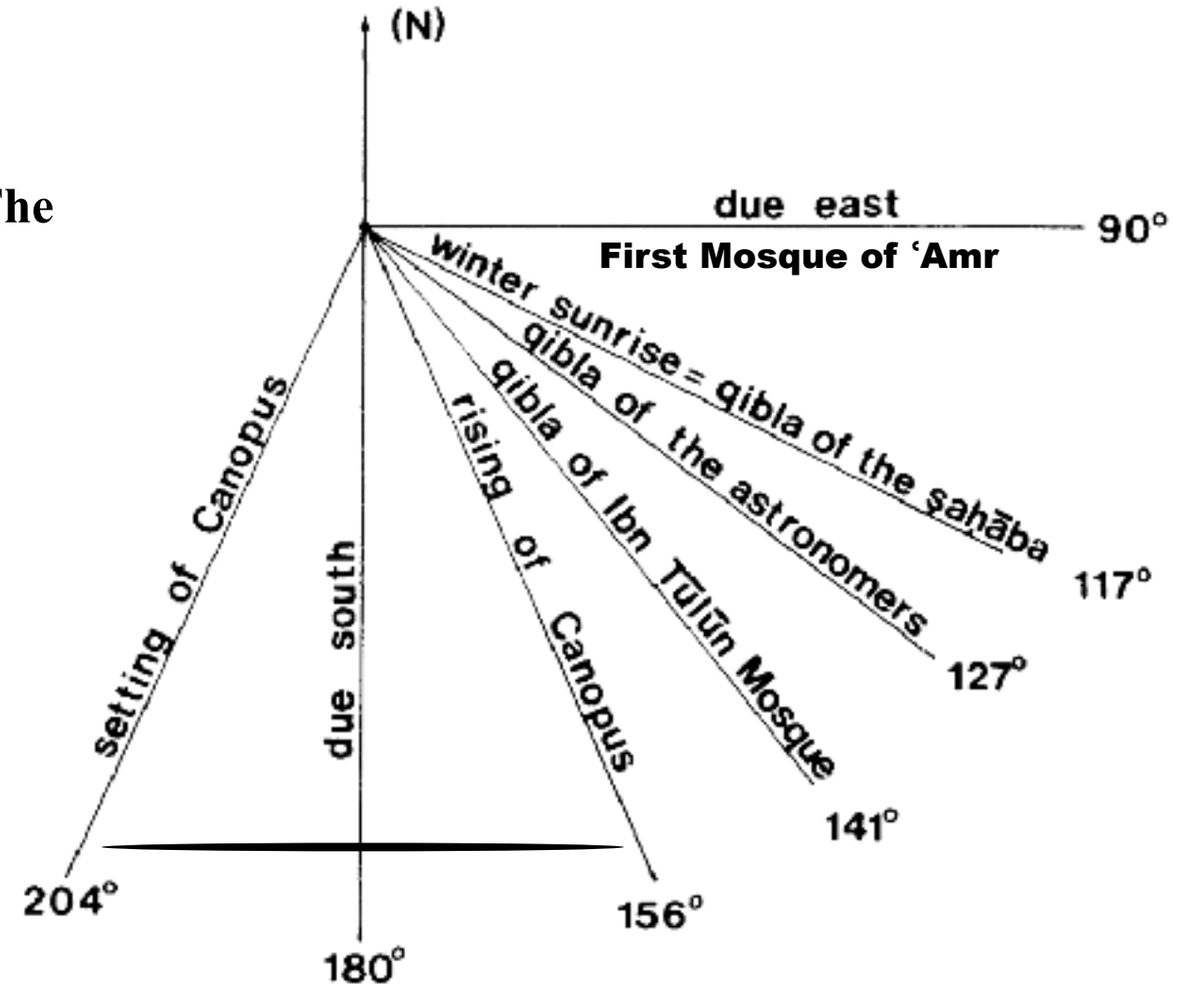
The port of the Fortress of Babylon on the Nile was the starting point of the Pharaonic Red Sea Canal, restored by the Romans and again by the Muslims. At upper right is a reconstruction by Nicholas Warner, the Fortress shown with its SW wall bordering the Nile. The Canal formed the major axis of the Fortress, whose minor axis was aligned about 10° south of winter sunrise. Obviously hydrological forces are at work here, not astronomical ones. Just outside the Fortress the Canal seems to have changed direction by about 10° to the left. The Mosque of ʿAmr was built near to the partly-ruined Fortress, in its second manifestation toward winter sunrise, perpendicular to the Canal. The new Fatimid city was laid out with its rectangular street-plan adjacent to the Canal, so that the minor axis pointed toward winter sunrise, which had already adopted as the *qibla* of the *ṣaḥāba,* some 10° north of the *qibla* of the astronomers. In the accompanying map, the Mosque is shown with what is perhaps intended to be its present orientation. (The Fatimids knew already about solstitially-aligned Roman cities with orthogonal street-plans since they came to Egypt from Tunisia; numerous examples are found in al-Andalus and the Maghrib, which accounts for some unexpected mosque orientations.)



www.mideastimage.com/cities/cairo.php
www.alamy.com/gateway-of-the-qasr-esh-shema-an-old-roman-fortress-robert-hay-illustrations-of-cairo-london-1840-image352777525.html

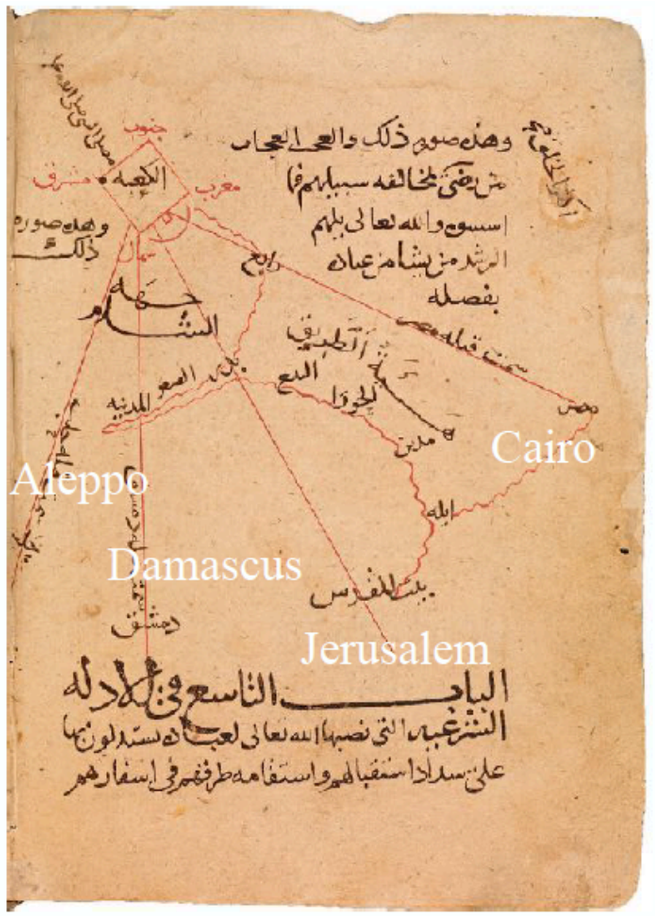
U8

Would that *qibla*s in Cairo were so simple. The diagram shows the various *qibla*s used in medieval Cairo according to the 15th-C historian al-Maqrīzī. This is actually over-simplified, and more original information is provided by the 12th-C legal scholar al-Dimyāṭī and the 14th-C historian Ibn Duqmāq. Not only have the orientations of the major and minor mosques never been investigated, but the medieval historical sources explaining them exist only in the original Arabic and have never been fully exploited for the information on orientations which they contain.



The first mosque in Egypt, the Mosque of ʿAmr in Fustat, was built facing toward due east, then demolished and rebuilt to face winter sunrise. Two most significant *qibla*s for Cairene religious architecture are what was called "the *qibla* of the Companions of the Prophet" (winter sunrise at 117°) and *the qibla* of the astronomers (calculated at 127°). A southerly direction was advocated by the followers of the legal school of the Shāfiʿīs, since that was the *qibla* of the Prophet during his sojourn in Medina, and south was also defined as any direction between the rising and setting of Canopus. The anomalous *qibla* of the Mosque of Ibn Ṭūlūn is associated with a legend. Similar palettes of *qibla* directions are known from Córdoba to Samarqand – see Pl. T14 above.

King, "Architecture and astronomy", p. 114.



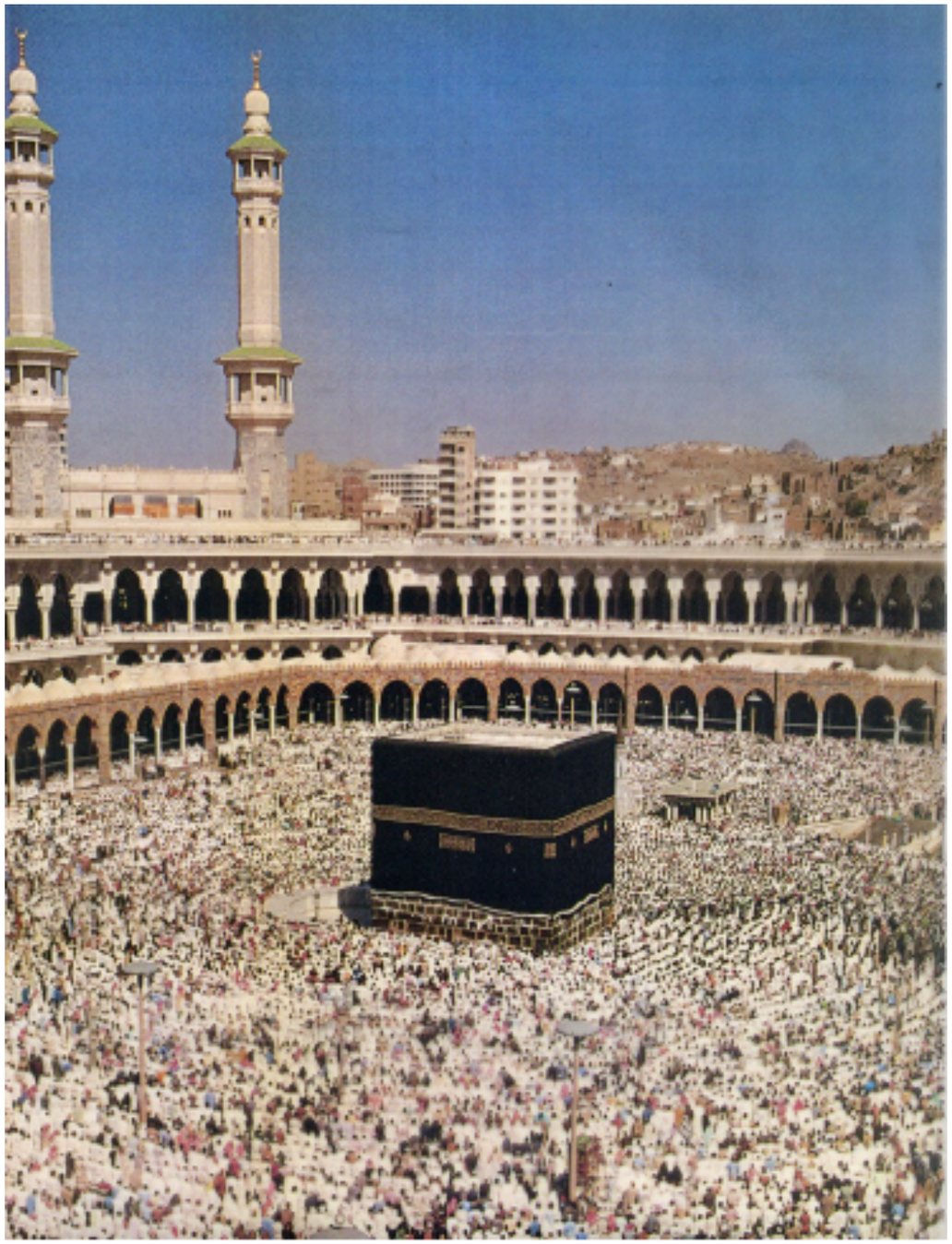
al-Dimyāṭī's diagram showing the relative positions of the major Mamluk cities with respect to different segments of the perimeter of the astronomically-aligned Kaʿba (see already Pl. T3). The *qibla* is toward the Kaʿba, not toward the city of Mecca. There were different ways to determine the *qibla*, indeed, two completely different ways: folk astronomy with astronomical risings and settings, and mathematical geography with longitudes & latitudes and calculations. That is the main reason why there are different orientations for historical mosques and why some of them appear strange to a modern.

Symptomatic of our age, in many ways a new *Jāhiliyya*, is the rise of revisionists who investigate historical mosque orientations, discover to their glee that these are not aligned in the modern direction of Mecca, and conclude they must have been built to face somewhere else. They achieve this without knowing anything about medieval *qibla* determinations, and their results are inevitably absurd. Nevertheless, again inevitably, they have a following.

MS Oxford Bodleian Hunt. 592, fol. 88v, courtesy of the Bodleian Library.

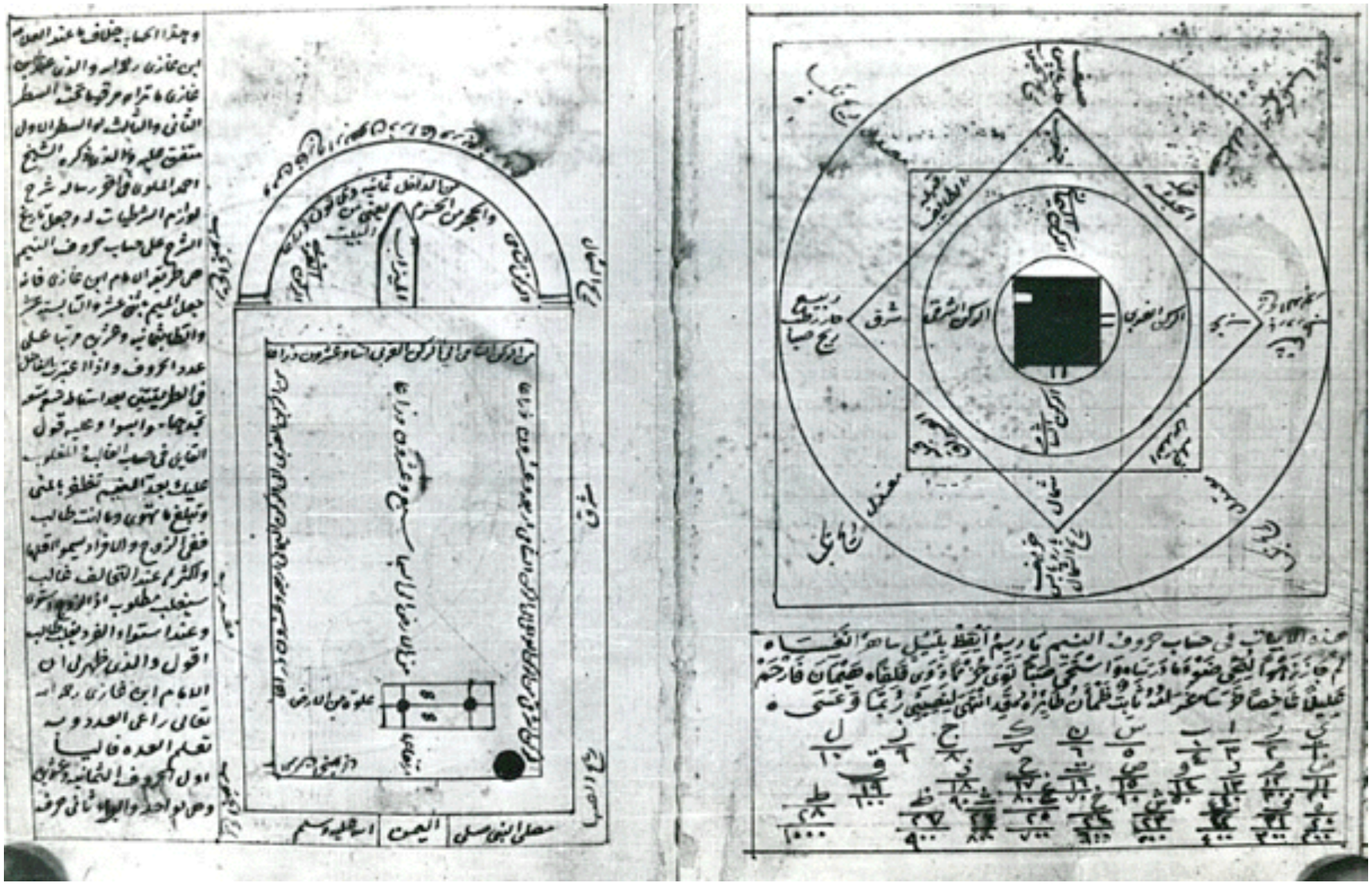
"Bibliography of books, articles and websites on historical *qibla* determinations" (2018), at www.academia.edu/37957276/.

U10



The Kaʿba has a history stretching back well over 1,500 years.

U11



What was the Kaʿba? Who built it and when? Why was it built?
What do we really know about it?
Why is it astronomically aligned?

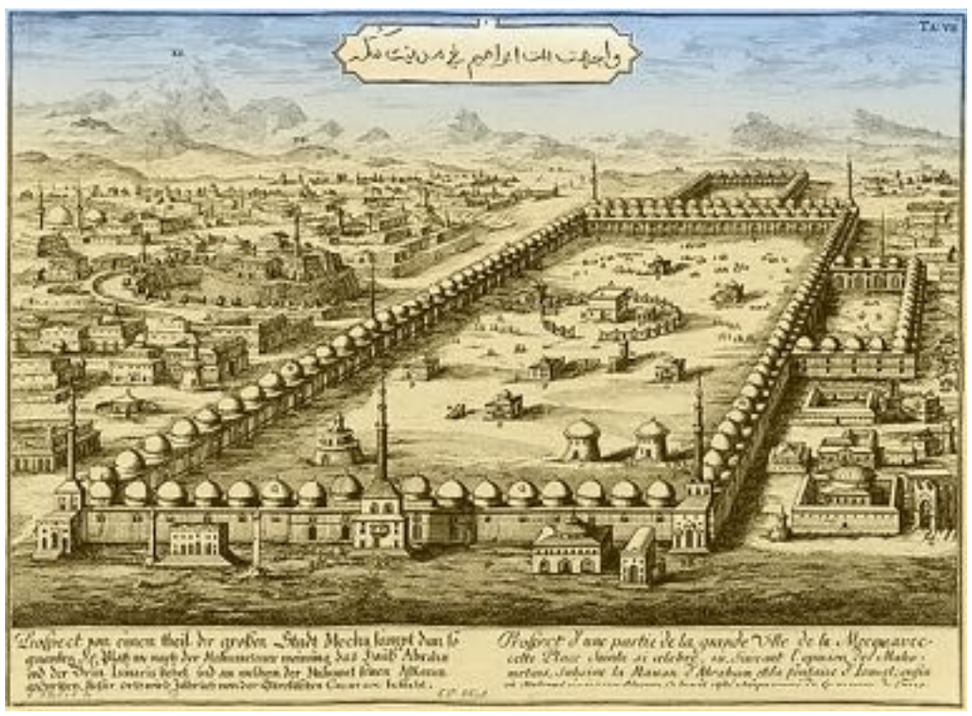
From MS Cairo Ṭalʿat *majāmīʿ* 811, courtesy of the Egyptian National Library.

U12

Source unknown

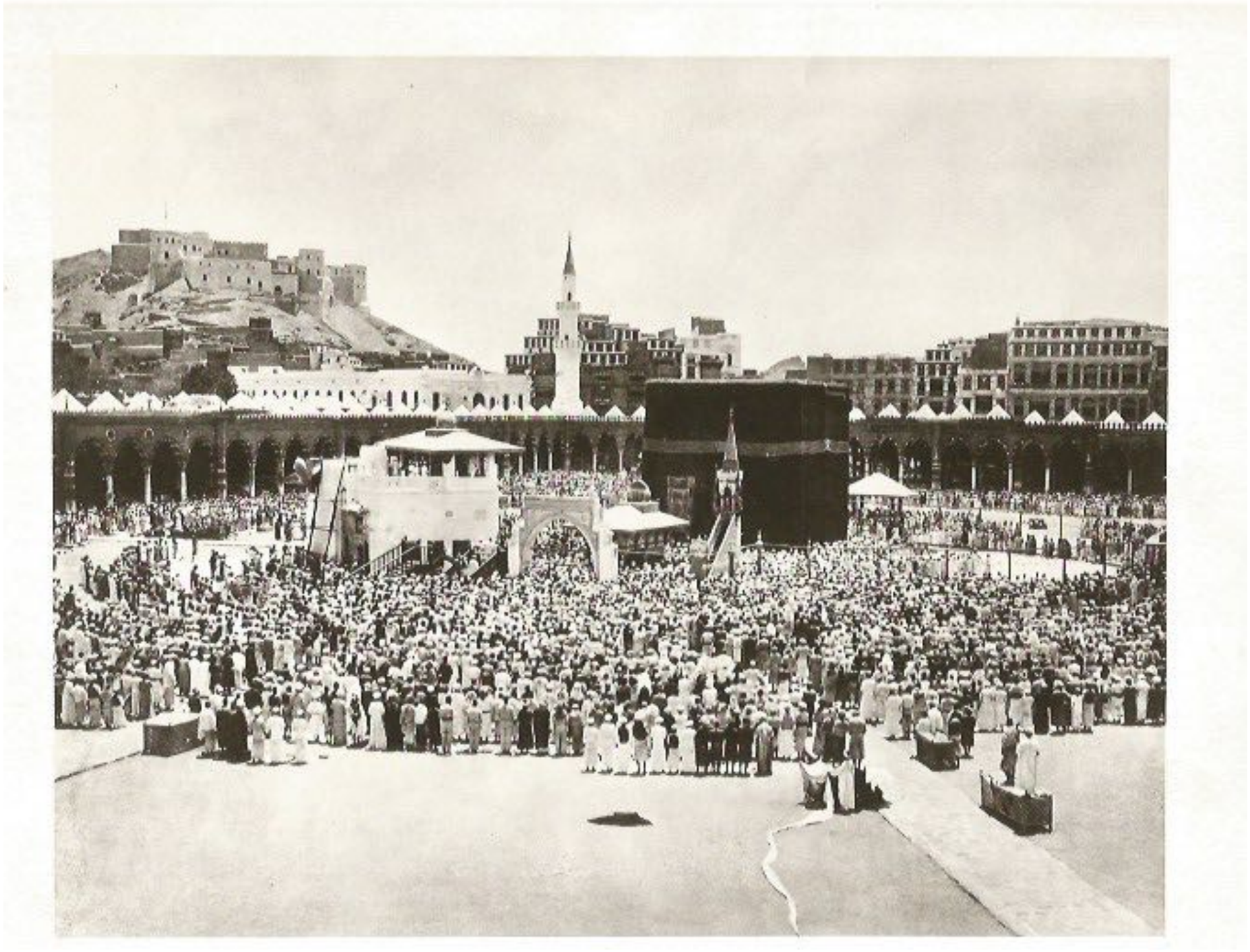
A model purporting to show the Kaʿba at the time of the Prophet Muḥammad. The edifice was originally a rectangular enclosure the height of a man. Its walls were built up with alternate layers of wood and stone already in 602 C.E. It stood so close to neighbouring houses that its shadow fell upon them. The tradition of covering the edifice with a decorated black cloth (*kiswa*) came later.

The astronomical orientation of the Kaʿba, documented already in medieval sources rediscovered in the early 1980s, takes into consideration the height of the mountains around the horizon of Mecca, which were clearly visible from the Kaʿba in the 7th C (but are no longer).



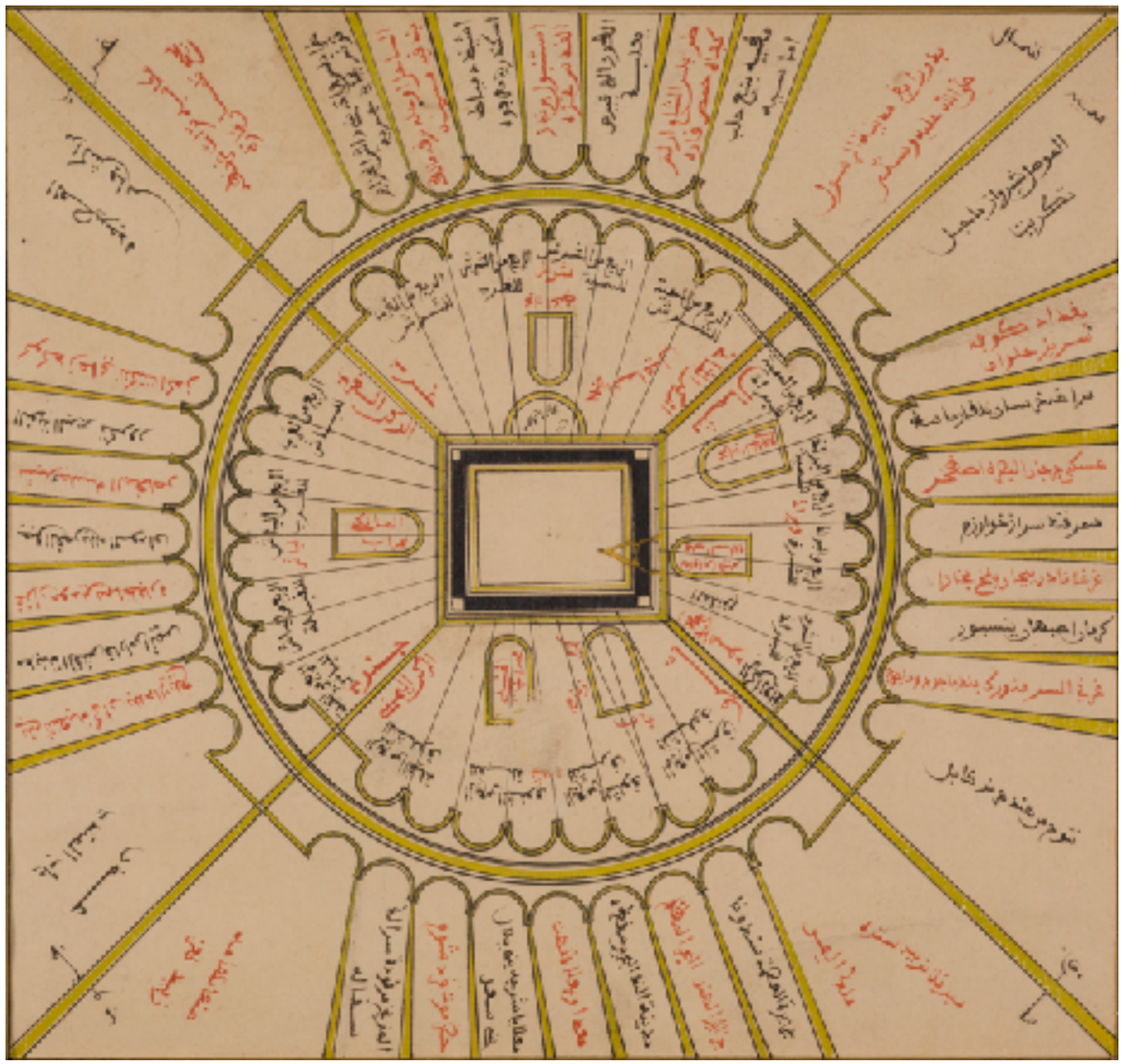
1712

U13



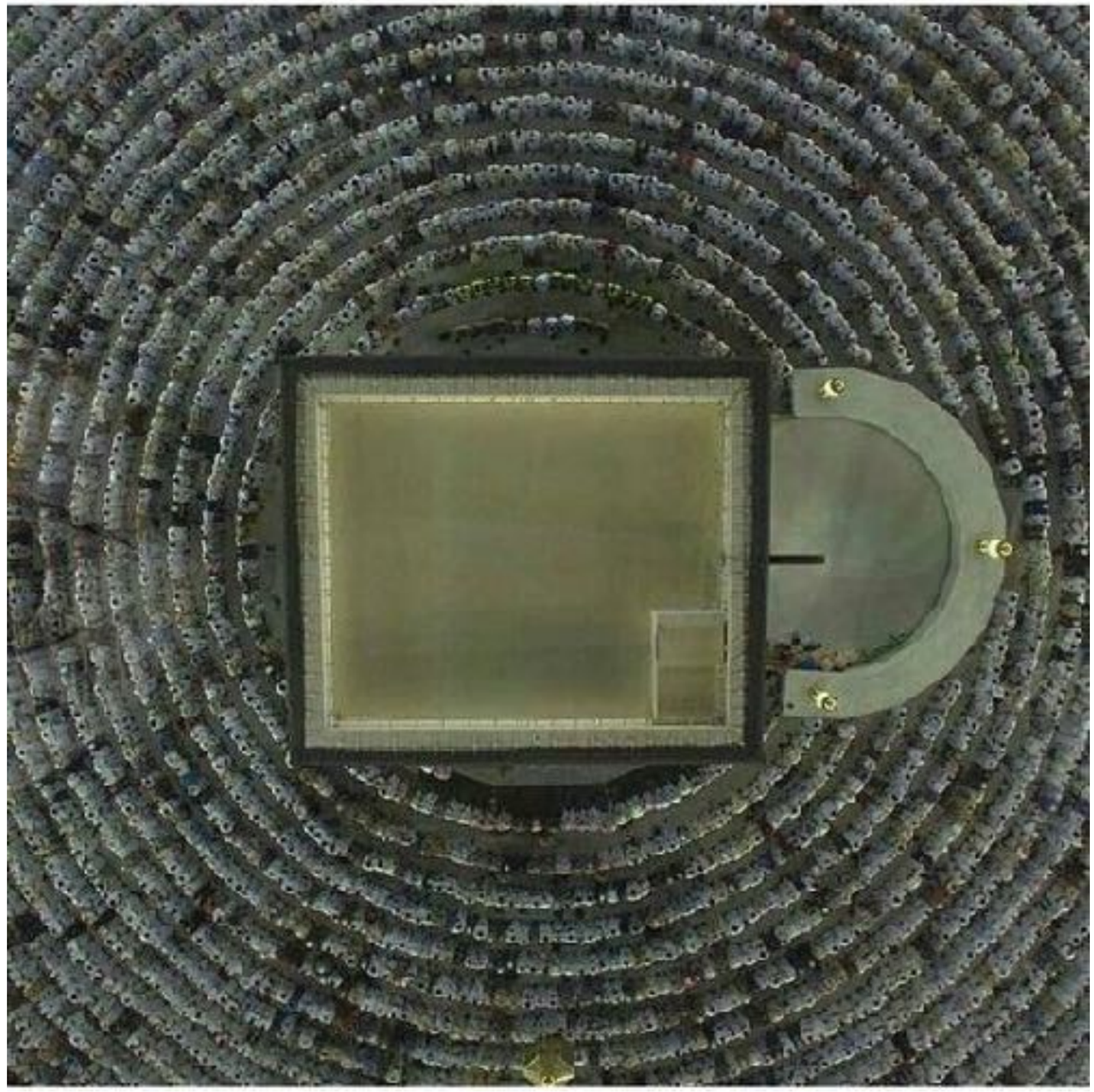
The Kaʿba in 1889.

bpk - bildarchiv preussischer kulturbesitz, courtesy of the Deutsche Staatsbibliothek, Berlin.



A 16th-C Maghribī scheme of sacred geography showing the orientation of 36 sectors of the world relative to segments of the perimeter of the Kaʿba. This scheme was discovered only in 2019.

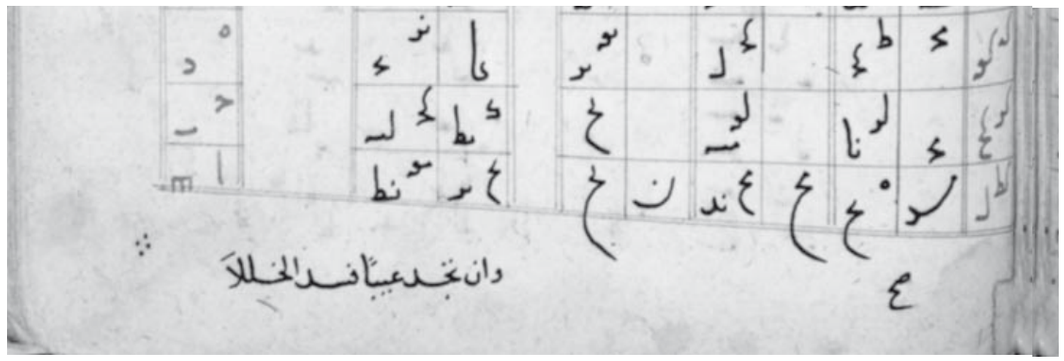
Courtesy of the Khalili Collection, London.



The Kaʿba from above, surrounded by pilgrims.
For Muslims, the Kaʿba is a symbol of the presence of the Divine.

www.pinterest.se/pin/370491506829811330/.

FINIS



The closing words of the scribe of a fine 14th-C manuscript (Dublin CB 3673) of the corpus of tables used in Cairo from the 10th to the 19th C for reckoning time by the sun and regulating the times of prayer. He pleads:

وإن تجد عيبا فسد الخللا – If you find a mistake, (please) fix it.

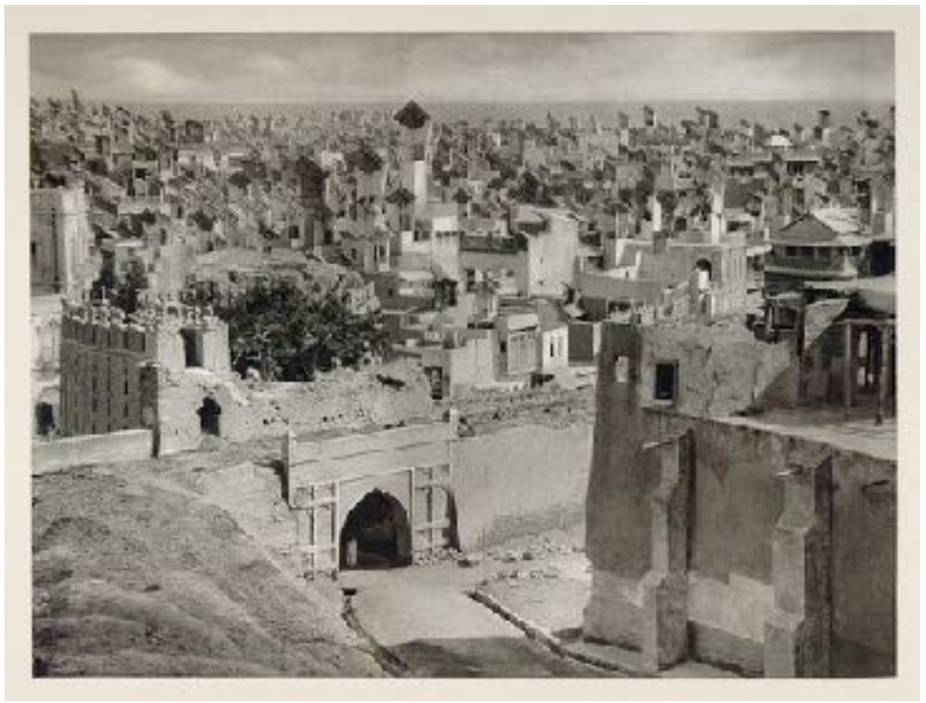
Sections V and W follow.

Note: Sections V and W are not related to the Cairo wind-catchers but they provide a context of sorts, showing other examples of the sensible use of wind energy and more besides.

V: Wind-towers old & new elsewhere

V1

Wind-catchers in Hyderabad, Sind, called *manghu* in Sindhi and an integral part of domestic architecture. The city was founded in 1768 and a British traveller Pottinger reported in 1815: "All the houses of the government palaces to the humble cottages have wind catchers." The city used to be known as *manghu-ju-shahur*, "City of *Manghus*". When electricity was introduced by the British during the early 1940s, the *manghus* were mainly replaced with electric fans and later with air-conditioning.



Talpur, "The vanishing glory of Hyderabad" (1958), esp. pp. 55 & 59;
& www.insideflows.org/project/ancient-wind-catchers-in-hyderabad/.

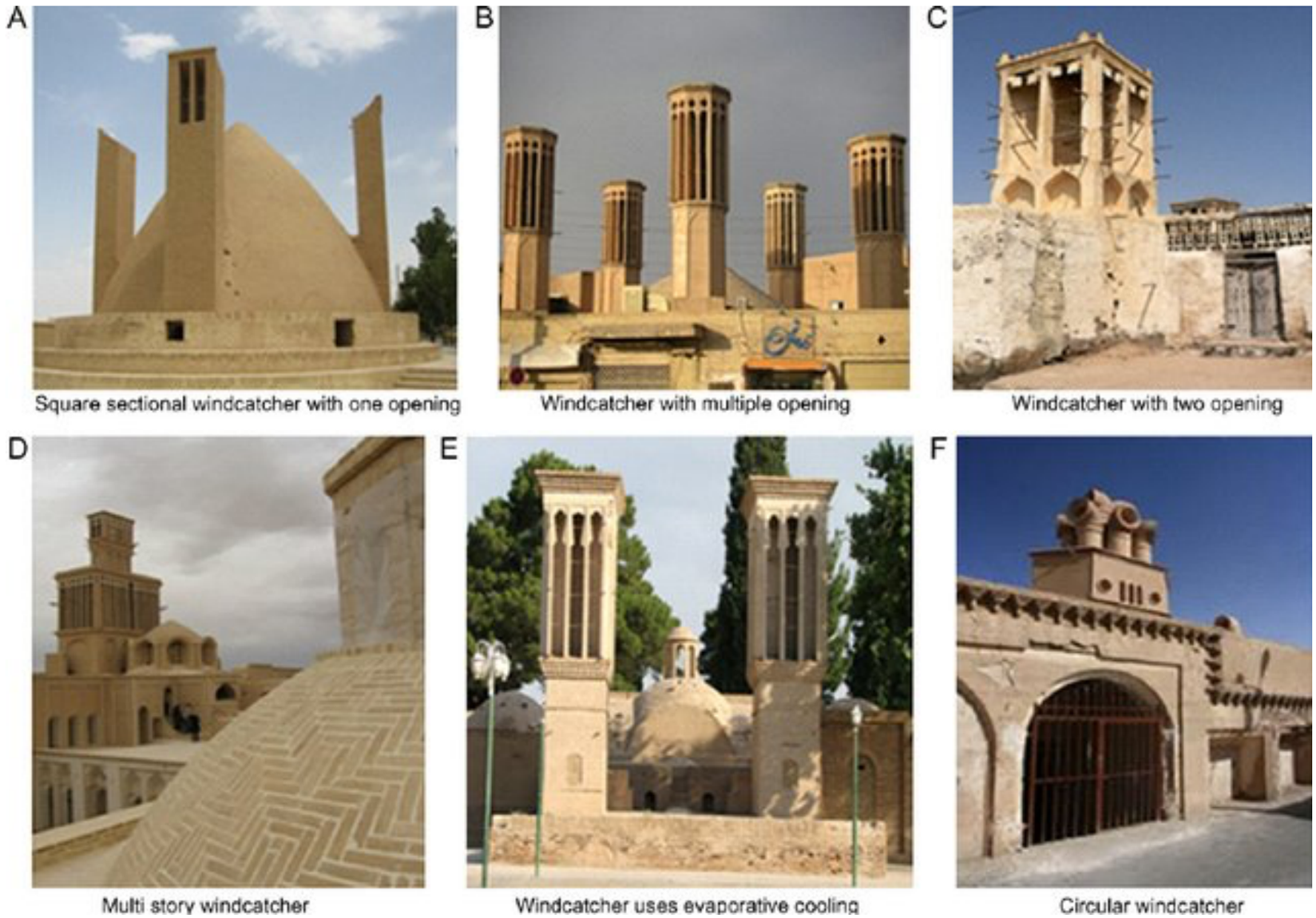
www.flickr.com/photos/eupalinos/4761097795/in/photostream/, *etc*.

V1a

External and internal views of a typical housing unit in Hassan Fathy's New Gourna, showing screen, dome, courtyard and wind-catcher.

Hisham Mortada, *Traditional Islamic Principles of Built Environment* (2003), p. 145.

V2



Numerous wind-towers in Iran, called *bādgīr* in Persian. Iran, with its indigenous culture dating back millennia, has the richest tradition of any country on earth of water-conservation and control for agricultural and domestic use (*qanāt*s), wind-utilisation (*bādgīr*s), and natural refrigeration and ice-production (*yakhchāl*s).

Saadatian & Lim & Sopian & Sulaiman, "Review of windcatcher technologies" (2012).

V3

Wind-towers in Abarquh, Iran.

Bahadori & Dehghani-sanij, *Wind Towers – Architecture, climate and sustainability* (2014), frontispiece.

V4

Dubai benefited from the relocation of Persian and Huwala merchants in the early 20th C.

Historical buildings with wind-towers in the suburb Al-Bestakiya of Dubai, founded in the 1890s by immigrants from Bastak in Iran. The restored houses on the right still have their Iranian-style wind-catchers.

Timothy Power & Peter Sheehan, "How Archaeology shapes History" (n.d.), at www.academia.edu/9550542/, www.tripadvisor.in/LocationPhotoDirectLink-g295424-i1857619-Dubai_Emirate_of_Dubai.html#1857619.

V5

A new type of wind-catcher used in the University of Qatar in Doha.

Saadatian & Lim & Sopian & Sulaiman, “Review of windcatcher technologies” (2012).

V6

2020 will mark the centenary of the beginning of the construction of the Holland Tunnel connecting Manhattan to New Jersey. The imposing ventilation towers at each end of the Tunnel ensure that the air stays fresh along its length (1.6 miles). The methods used to design and build it still form the basis for the construction of many underwater vehicular tunnels throughout the world.

"The history of a unique engineering achievement – The Holland Tunnel", at

www.asme.org/wwwasmeorg/media/resourcefiles/aboutasme/who%20we%20are/engineering%20history/landmarks/93-holland-tunnel-ventilation-system.pdf.

V7

In all of the vast literature on the dynamics of wind-use for cooling purposes the only author who took the time and effort to imagine modern housing profiting from wind-catchers after the Cairene model is the Egyptian engineer Mostafa El-Gamal. His 2014 Master's thesis presented at HafenCity University in Hamburg is entitled *Resource Efficient Architecture and Planning for Egypt: Obstacles and Potentials of the Modern Application of Egyptian Vernacular Architecture and Planning*. The pre-condition necessary for adopting such uni-directional devices in a location where the favourable winds are essentially from the same direction, as in Cairo, would be the appropriate orientation of the parallel streets. If the wind-catchers face due north then the sides of the scoops should perhaps also be open (at least according to medieval astronomers). A modern meteorologist could surely advise.

Mostafa El-Gamal, *Resource Efficient Architecture and Planning for Egypt* (2014), fig. 69.

V8

The German *Strandkorb* or 'hooded beach chair' is a familiar sight on the beaches of the North Sea and the Baltic coasts during summer months. It is designed to protect the vacationer from wind, rain, sand-gusts, sunburn, and unwanted spectators. Others might prefer to vacation elsewhere or to stay at home.

www.schoener-wohnen.de/einrichten/garten-terrasse/34731-bstr-strandkoerbe-ein-stueck-urlaub-im-eigenen-garten

V9

A house called “WINDCATCHER” designed and built by students of the University of Colorado at Denver for a single mother: “Inspired by the wind, shaped by the heart”.

www.designbuildbluff.org/index.php/project_page/work-2010-windcatcher/.

V9a

Wind-towers at the Torrent Research Centre in Ahmedabad, India. And they work!*
This image was found in an article by Olivier Rey in *Red Dirt Report* (Oklahoma), 16.03.2016, entitled "Windcatcher could save billion dollars a year in home cooling".**

*** See Ford & Patel & Zaveri & Hewitt, "Cooling without air conditioning: The Torrent Research Centre ... " (1998).**
**** www.reddirtreport.com/slice-o-life/windcatcher-could-save-billion-dollars-year-home-cooling.**

V10

Nowadays *malqaf*s of one sort or another are available for the rich and for shelters from sun and wind are available for the poor … … .

www.pinterest.com/pin/297870962845420104/?lp=true .

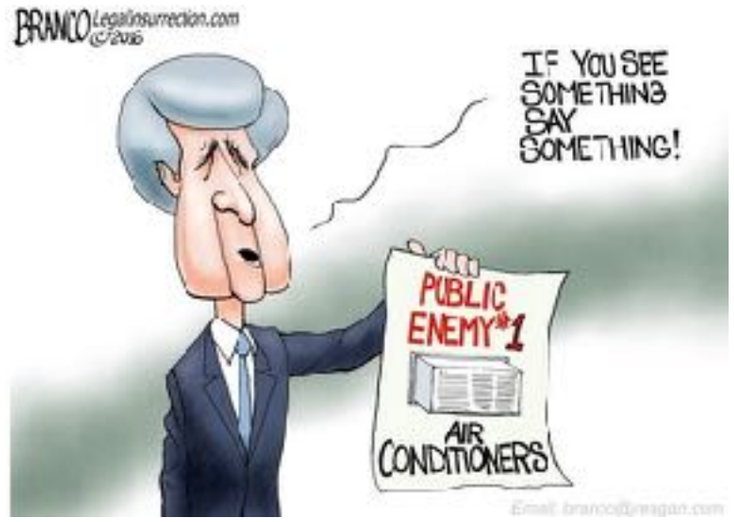
294176-ملقف-الهوا.PNG,

W: Miscellaneous modern alternatives

Apartment air conditioning units in Hong Kong.

https://unsplash.com/photos/f1f-FQj0k0U

It doesn't have to be like this. See, for example, Susan Roaf, "Air-conditioning avoidance: lessons from the windcatchers of Iran" (2005).



DAK@a/c.sharjah2008.uae

W1a

First Kuwaiti: "Yes, we're under pressure, not just from rising temperatures, but sea level rises – the demand for electricity and water will also be harder in the future." Second Kuwaiti: "But we're prepared – we have air conditioning everywhere!"

Kuwaiti officials quoted in Michaelson, "Kuwait's inferno" (2017).

See Jacopo Prisco, "Why it's time to redesign the old air conditioner" (2019).

www.cnn.com/style/article/global-cooling-prize-india/index.html.

See also www.dailymail.co.uk/sciencetech/article-7588593/Qatar-hot-capital-city-air-conditioning-OUTDOORS.html

W2

Where once the wind-catchers had stood on
the roofs of the medieval houses of this part of Cairo,
their place was taken by TV satellite bowls.
Lucille Ball and Vivian Vance would rightly have been horrified.

The ‘wind-towers’ (براجيل , *barājīl*) on the imposing Central Market in Sharjah, built by British architects, serve no practical purpose; they were added for aesthetic ends. I confess they had me fooled during several visits because the *sūq* was pleasantly cool inside.

https://universes.art/en/art-destinations/sharjah/other-places/central-souk/01/ – see Boudiaf, “On Ecology and Culture” (2018).

W3a

An old photo of wind-catchers on official buildings in Hyderabad (Pakistan) – see also Pl. V1. They face south-west, whence come favourable winds (though this is now changing). The wind-shafts were open in summer during the night and in winter during the day. On private houses the the wooden scoops were susceptible to termites.

Some modern buildings in Hyderabad, including the Aga Khan Maternity Hospital seen here, sport wind-catchers, but they are purely decorative.

Two images above from
Erika Alatalo, "Searching for windcatchers in Hyderabad" (2016), at www.fieldstudyoftheworld.com/searching-windcatchers-hyderabad/.

https://images.app.goo.gl/Sf2oLsddrqpk5uxx9

W4

A monumental wind-tower in Masdar City, the new environmentally-friendly city near Abu Dhabi. The purpose of this tower is apparently to cool the plaza beneath it. The effects on the greenery achieved by this rather ambitious undertaking are clearly visible, although the local residents appear to be indoors. Notice the wind-catchers (?) or solar panels (?) on the roof of the building.

In this image the trees are wilting a bit and a human being has emerged to enjoy the cool.

W5

Wind-turbines (*éoliennes*) galore!

Jérôme Marin, "Vents porteurs pour l'éolien en France", *La Tribune*, 08.10.2019, at www.latribune.fr/entreprises-finance/industrie/energie-environnement/vents-porteurs-pour-l-eolien-en-france-830020.html.

"I know windmills [*sic*] very much. I've studied it better than anybody. I know more about technology than anybody. Nobody knows more about technology than me. … … (The windmills) are noisy. They kill the birds. … I've seen the most beautiful fields, farms, fields, the most gorgeous things you've ever seen, and then you have these ugly things going up. … ." A self-styled technology expert, December, 2019.

www.youtube.com/watch?v=ec9P3C1OXqE & https://edition.cnn.com/2019/12/25/opinions/whats-behind-•••••s-nonsense-on-windmills-and-light-bulbs-sachs/index.html.

W6

www.pinterest.com/pin/327003622923336714/

Left: These sensible *malqaf*s next to the funnel of a steam-ship serve to ventilate and cool the engine-room below.

Above: A famous architect conceived these monstrous things to ventilate underground parking in Frankfurt. Bamboo was planted to hide them, at least during the summer. The same adorn the Centre Pompidou in Paris.

"Extreme events linked to climate change, such as the heatwave in Europe this year, are occurring sooner than expected, an ex-chief scientist says. Prof Sir David King says he's been scared by the number of extreme events, and he called for the UK to advance its climate targets by 10 years."
Roger Harrabin, "Faster pace of climate change is 'scary', former chief scientist says", BBC, 16.09.2019. (No relative.)

W7

and the future … … ??

“Fresh Air, le dispositif de refroidissement portatif bon marché que les Français s’arrachent cet été.”
Rolland Moroy | 21 juin 2019 at new-trends.net. Also www.mc-gadgets.com/.

“It’s going to be a long, hot, and uncomfortable summer season in France.”
“There is incontrovertible evidence that global temperatures are rising everywhere.”
瑞士工程师设计出智能空调AirFreez，全球销量超百万台
文章来源： 贤集网　　发布时间：2019-07-04 作者：AirFreez
https://handytechgadgets.com/ & www.xianjichina.com/special/detail_408861.html

Colds, fever, headache, stiff neck, earache, laryngitis, asthma, bronchitis, ……. .

Catching at least one of these guaranteed.

W7a

Or you can purchase your own air-conditioning unit and wear it … …

before **after**

Tiny Device Helps You Relax In Horrible Hot Weather. The Idea Is Genius...

30/06/2020 | Jason Mann

What Are We Talking About?

It's called the **NeckBreeze**, and its the best way to keep nice and cool on the go.

99% of Users Recommend the NeckBreeze to Their Friends and Family

https://topgadgetadvisor.com/neckbreeze-review

What you can expect with Blaux Wearable AC

4x Blaux Wearable AC – Family Protection Pack

~~Reg 430,71 €~~
Only 192,47 €

www.top10gadgets.shop/blaux-wearable-ac-review/
www.reviewpadho.com/blaux-wearable-ac-review-2020/
www.change-and-achievement.com/blaux-wearable-ac/

DAK: We've come a long way since the Middle Ages, especially in gadgetry and marketing, if not in common sense.

A message to future generations placed on a dead glacier

**"Jökullok is the first Icelandic glacier to lose its status as a glacier.
In the next 200 years all our glaciers are expected to follow the same path.
This monument is to acknowledge that we know what is happening and
what needs to be done. Only you future generations will know if we did it.
In August, 2019, the Carbon Dioxide level is at 415 parts per million."**

Paraphrased from Andri Snær Magnason, "The glaciers of Iceland seemed eternal; now a country mourns their loss", *The Guardian* 14.08.2019, available at www.theguardian.com/commentisfree/2019/aug/14/glaciers-iceland-country-loss-plaque-climate-crisis.
See also https://edition.cnn.com/2019/09/22/europe/swiss-glacier-funeral-intl-scli/index.html.

www.amazon.de/One-Small-Make-Difference-English-ebook/dp/B07XXD3Q1B